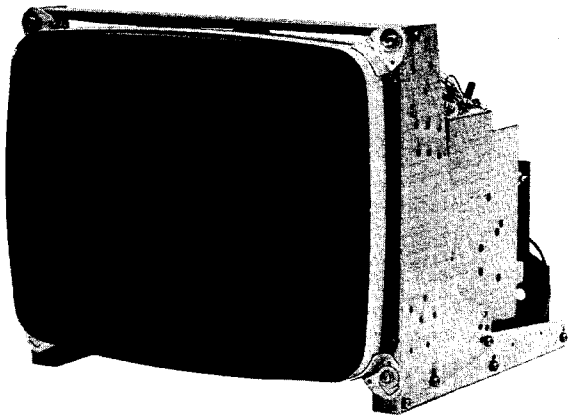
VIDE-V28805
ORDER NO. FTD87055115C1
G1

Service Manual

Color Computer Monitor

MODEL TX-1440A

Chassis No. X25HB



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Panasonic®

Panasonic Industrial Company Division of
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SAFETY PRECAUTIONS

1 CAUTION

No modification of any circuit should be attempted. Service work should only be performed after you are thoroughly familiar with all of the following safety checks and servicing guide lines.

2 SAFETY CHECK

Care should be taken while servicing this CRT display because of the high voltage used in the deflection circuits. These voltages are exposed the flyback and yoke circuits.

3 FIRE & SHOCK HAZARD

3-1 Insert an isolation transformer between the CRT display and the AC power line before servicing the chassis.

3-2 When servicing, pay attention to original lead dressing especially in the high voltage circuit. If a short circuit is found, replace all parts which have been overheated as a result of the short circuit.

3-3 All the protective devices must be reinstalled per original design.

3-4 Soldering must be inspected for possible cold solder joints, frayed leads, damaged insulation, solder splashes or sharp solder points. Be certain to remove all foreign material.

4 LEAKAGE CURRENT COLD CHECK

4-1 Unplug the AC cord and connect a jumper between the two prongs on the plug.

4-2 Turn the CRT display power switch "on".

4-3 Measure the resistance value with an ohmmeter between the jumpered AC plug and each exposed metallic part on the CRT display such as the metal frame screwheads, control shafts, etc. When the exposed metallic part has a return path to the chassis, the reading should be 1.8 megaohm minimum.

5 LEAKAGE CURRENT HOT CHECK

5-1 Plug the AC cord directly into the AC outlet. Do not use an isolation transformer during this check.

5-2 Connect a 1500 ohm, 10 watt resistor in parallel with a 0.15μF capacitor between each exposed metallic part and a good earth ground (as shown in Figure 1).

5-3 Use an AC voltmeter with 1000 ohm/volt or more sensitivity and measure the AC voltage across the combination 1500 ohm resistor and 0.15μF capacitor.

5-4 Move the resistor connection to each exposed metallic part and measure the voltage.

5-5 Reverse the polarity of the AC plug in the AC outlet and repeat the above measurement.

5-6 Voltage measured must not exceed 7.5 volt RMS, from any exposed metallic part to ground. A current leakage tester may be used in the above hot check, in which case any current measured must not exceed 5.0 milliamps. In the case of a measurement exceeding 5.0-milliamp value, a rework is required to eliminate the chance of a shock hazard.

Note : High voltage is present when this CRT display is operating. Always discharge the anode of the picture tube to the display chassis to prevent shock hazard.

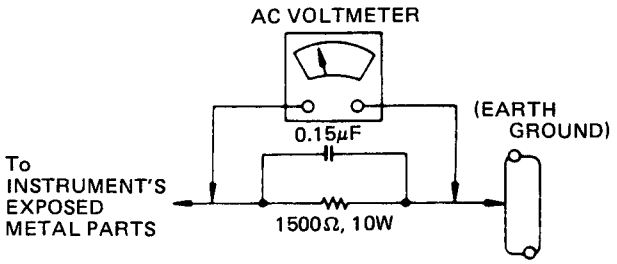


Figure 1

6 IMPLOSION PROTECTION

All Panasonic picture tubes are equipped with an integral implosion protection system, but care should be taken to avoid damage and scratching during installation. Use only Panasonic replacement picture tubes.

7 X-RADIATION

WARNING : The only potential source of X-Radiation is the picture tube. However when the high voltage circuitry is operating properly there is no possibility of X-Radiation problem. The basic precaution which must be exercised is to keep the high voltage at the following factory-recommended level.

Note : It is important to use an accurate periodically calibrated high voltage meter.

7-1 To measure the high voltage, use a high impedance high voltage meter, connect (−) to chassis and (+) to the CRT anode button.

7-2 Turn the Brightness control fully counterclockwise.

7-3 Measure the high voltage. The high voltage meter should indicate at the following factory-recommended level.

7-4 If the upper meter indication exceeds the maximum level, immediate service is required to prevent the possibility of premature component failure.

7-5 To prevent X-Radiation possibility, it is essential to use the specified picture tube.

7-6 The nominal high voltage is 25KV and must not exceed 28.5KV at zero beam current at rated voltage.

IMPORTANT SAFETY NOTICE

There are special components used in Panasonic CRT displays which are important for safety. These parts are identified by the international symbol ⚠ on the schematic diagram and on the replacement parts list. It is essential that these critical parts should be replaced with manufacture's specified parts to prevent X-RADIATION, shock, fire or other hazards. Do not modify the original design without written permission of the Panasonic Industrial Company or this will void the original parts and labor guarantee.

SPECIFICATION

1. SCOPE

The purpose of this specification is to describe the cabinet type color display monitor which is able to function for 2 modes.

2. MECHANICAL DESCRIPTION

2.1 Dimensions

Height :	11.3" (287 mm) typ.
Width :	13.6" (346 mm) typ.
Depth :	14.6" (370 mm) typ.

2.2 Weight

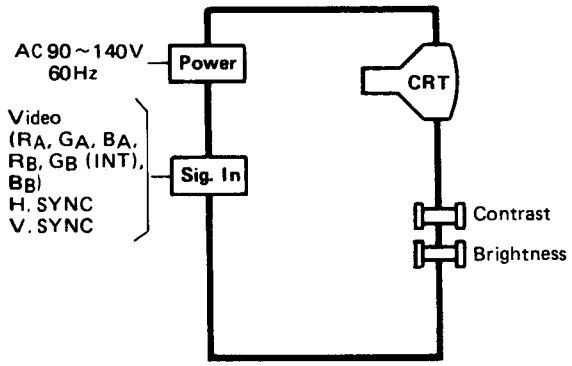
Net weight (Monitor only)	25.4 lbs (11.5 kg)
Gross weight (Monitor with package for transportation)	30.9 lbs (14 kg)

2.3 Tilt Angle

Adjustable :	0°, 2.5°, 5°, 7.5°, 10°
Fixed at factory :	0°

3. CONSTRUCTION

3.1 Outline



3.2 CRT characteristics

Size :	14 inch diagonal
Matrix :	Black opaque material
Matrix type :	Negative guard band
Faceplate type :	Contrast enhancement, Direct Etched
CRT type No.	M34JEF80X
Phosphor :	P22
Persistance :	Short
Array :	Dot trios
Trio pitch :	0.31 mm typ. at center

4. ENVIRONMENTAL CHARACTERISTICS

4.1 Temperature, Humidity and Altitude

4.1.1 Operating conditions

Temperature :	32°F ~ 122°F (0°C ~ 50°C)
Humidity :	5 ~ 90% (no condensation)
Altitude :	10000 ft max. (3000m)

4.1.2 Non-Operating conditions

Temperature :	–40°F ~ +149°F (–40°C ~ +65°C)
Humidity :	5 ~ 90% (no condensation)
Altitude :	40000 ft max. (12000m)

4.1.3 Storage and Shipment

Temperature :	–40°F ~ +149°F (–40°C ~ +65°C)
Humidity :	5 ~ 90% (no condensation)
Altitude :	40000 ft max. (12000m)

5. ELECTRIC PERFORMANCE

5.1 Power Supply

Input voltage :	AC 90 ~ 140V
Input frequency :	58 ~ 62Hz
Input current :	1.0A max. (at 115V AC)
Power :	75W max.

5.2 Input signals

5.2.1 Video signal

(RA, GA, BA, RB, GB (INT), BB)

Polarity : Positive

Signal level : TTL level

(See function table on page 5 and 6)

Frequency : Mode 1 ..... 14.3182 MHz

Mode 2 ..... 16.257 MHz

Note : Max rise and fall times (from 10% to 90%) of input signals are less than 5ns.

5.2.2 Horizontal Synchronization signal

Polarity : Positive

Signal level: TTL level

Frequency: Mode 1 ..... 15.7 kHz

Mode 2 ..... 21.85 kHz

5.2.3 Vertical Synchronization signal

Polarity : Mode 1 ..... Positive

Mode 2 ..... Negative

Signal level : TTL level

Frequency : 60 Hz

Note : The monitor detects vertical sync polarity and automatically select either mode.

5.3 Signal timing

See figure 2 on page 5.

5.4 Video out

Amplifier response

The video amplifier shall produce a drive signal at the cathodes of the CRT of sufficient amplitude to produce a spot luminance of maximum luminance (RA, GA, BA, RB, GB, BB = H), with rise and fall times of less than 40 nsec from 10% to 90% pulse level.

6. OPTICAL CHARACTERISTICS

6.1 Image test condition

Character : All "H" character

Color : Green

Brightness control : Max. (without background)

Contrast control : Max

View direction : Parallel to the CRT axis

Ambient Temperature : Room temperature

Supply voltage : AC 115V, 60Hz

Terrestrial magnetism : Horizontal field ..... 0 Gauss

Vertical field ..... 0.4 Gauss

Note : All measurements shall be made under normal conditions after an intial warm-up time of more than 20 minutes.

Note : Normal conditions are these which satisfy image test condition.

(Condition of each following item is normal condition unless otherwise stated.)

6.2 Image

6.2.1 Image size

Horizontal: Mode 1 ... 9.84 ± 0.2" (250 ± 5mm)

Mode 2 ... 9.84 ± 0.2" (250 ± 5mm)

Vertical: Mode 1 ... 6.69 ± 0.2" (170 ± 5mm)

Mode 2 ... 6.69 ± 0.2" (170 ± 5mm)

Testing condition is normal condition.

6.2.2 Image position

Image is within the area in figure 5 on page 7.

$|A - B| \leqq 0.236"$ (6 mm)

$|C - D| \leqq 0.236"$ (6 mm)

Testing condition is normal condition.

6.2.3 Distortion

(A) Pincushion

See figure 6 on page 7.

Upper (a)..... Less than 0.098" (2.5mm)

Lower (b) .... Less than 0.098" (2.5mm)

Right (c) and

Left (d) ..... Less than 0.098" (2.5mm)

Input signal is a crosshatch pattern. Other conditions are as stated in 6.1 Image test condition.

(B) Rectangularness & Parallelogram distortion

Edge of the image is within the area indicated by the dotted line in figure 7 on page 7.

a ..... 0.157" (4mm)

b ..... 0.157" (4mm)

Input signal is a crosshatch pattern.

Other conditions are as stated in 6.1 Image test condition.

(C) Linearity

Horizontal and vertical linearity shall be less than 7%.

See figure 8 on page 8.

Input signal is a crosshatch pattern. Other conditions are as stated in 6.1 Image test condition.

(D) Rotation

Horizontal center line of the image shall be within the shaded area in figure 9 on page 8.

a ..... 0.098" (2.5mm)

Input signal is a crosshatch pattern. Other conditions area as stated in 6.1 Image test condition.

(E) Convergence

See figure 10 on page 8.

Mis-convergence in area (A) $\leqq$ 0.0197" (0.5 mm)

Mis-convergence in area (B) $\leqq$ 0.0276" (0.7 mm)

Note : Should be measured under the following conditions.
1) Terrestrial Magnetism without horizontal field (0 Gauss).
With vertical field of 0.4 Gauss
2) At room temperature
3) Input signal Crosshatch R,G, B mixed colors.

6.3 Luminance

Luminance shall be more than 150 cd/m² (43.8 ft-L) at the center of the CRT.

1. Input signal ..... White window, 100 x 100mm (3.94 x 3.94") max scale in 4 brightness signal levels.
2. Brightness and contrast controls ..... Maximum

6.4 Image size variation

Notes and test conditions	Image size variation from the normal image size
Rotation of brightness VR	Within 0.157" (4 mm) (Horizontal and Vertical)
AC line voltage varied 90 to 140 volts	Within ± 0.157" (4mm) (Horizontal and Vertical)
External ambient temperature varied 25 ± 25°C	Within ± 0.157" (4mm) (Horizontal and Vertical)

Testing condition is normal condition.

7. OVERALL PERFORMANCE

7.1 Resolution

Horizontal ..... 810 Pixels
Vertical ..... 670 Pixels

7.2 Insulation

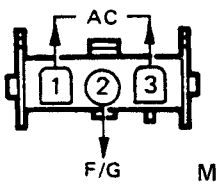
More than 100 MΩ
(Between AC line and chassis).

7.3 Jitter

Less than 1 dot
Invisible at a distance of 17.7" (45 cm) from CRT surface.

8. CONNECTOR

8.1 Power connector



[1] [3] Power input
AC 90 ~ 140V
60 Hz
[2] Frame ground

MFR ..... AMP Lock connector.

Display Side	Customer Side
3-Cap-housing (350767-1)	Connector (350766-1)
Pin Contact (350561-1)	Contact (350570-1)

8.2 Signal connector

9 Pin D-Subminiature connector.

Pin No.	Description
1	Signal ground
2	Red video MSB (R_B)
3	Red video LSB (R_A)
4	Green video LSB (G_A)
5	Blue video LSB (B_A)
6	Green video MSB (G_B)
7	Blue video MSB (B_B)
8	H. Sync
9	V. Sync

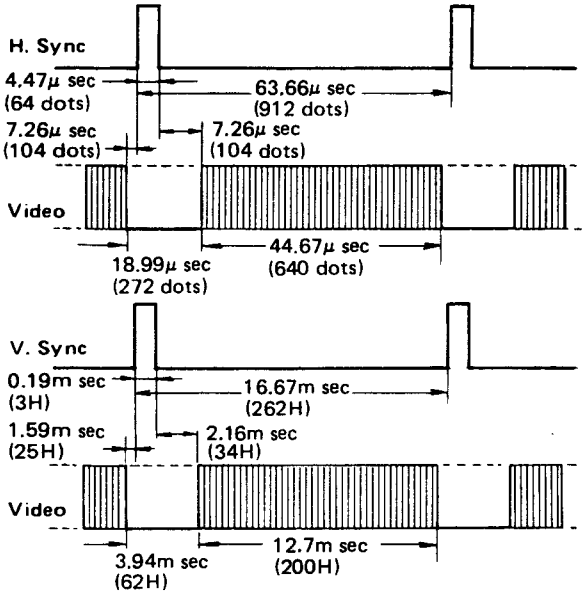
R_A ..... Red
G_A ..... Green
B_A ..... Blue
R_B ..... Red secondary
G_B ..... Green secondary (Intensity)
B_B ..... Blue secondary

9. SAFETY SPECIFICATION

Shall be certified with

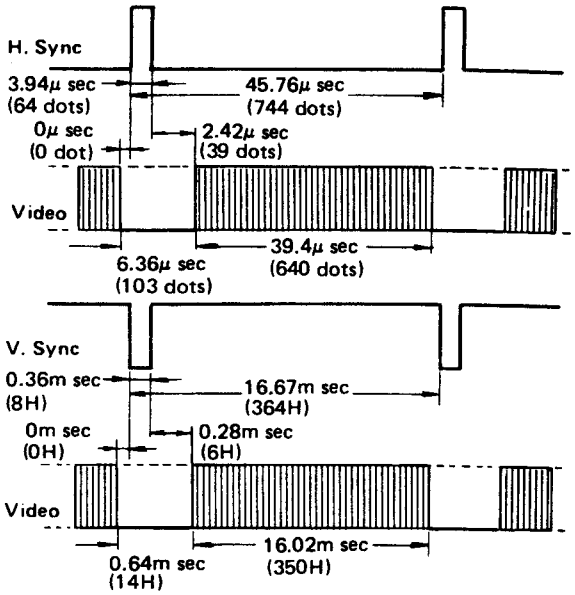
UL	478
UL	114
CSA	C22.2 No. 154
FCC	Class B

[Mode 1]



NOTE: Pixel rate 14.3182 MHz
Pixel period 69.797 nsec
Scanning mode: Non-interlaced

[Mode 2]



NOTE: Pixel rate 16.257 MHz
Pixel period 61.51 nsec
Scanning mode: Non-interlaced

Figure 2
SIGNAL TIMING

MODE 1 : FUNCTION TABLE (16 COLORS)

[Vertical Sync Polarity : Positive]

	Input Video Signal				Relative Output Level				Note	
No.	GB(I)	RA	GA	BA	R%	G%	B%	color name	cont	bright
1	0	0	0	0	0	0	0	Black	X	X
2	0	0	0	1	0	0	66	Blue	X	O
3	0	0	1	0	0	66	0	Green	X	O
4	0	0	1	1	0	66	66	Cyan	X	O
5	0	1	0	0	66	0	0	Red	X	O
6	0	1	0	1	66	0	66	Magenta	X	O
7	0	1	1	0	66	66	0	Brown	O	O
8	0	1	1	1	66	66	66	Light Gray	X	O
9	1	0	0	0	33	33	33	Dark Gray	O	O
10	1	0	0	1	33	33	100	Light Blue	O	O
11	1	0	1	0	33	100	33	Light Green	O	O
12	1	0	1	1	33	100	100	Light Cyan	O	O
13	1	1	0	0	100	33	33	Light Red	O	O
14	1	1	0	1	100	33	100	Light Magenta	O	O
15	1	1	1	0	100	100	33	Yellow	O	O
16	1	1	1	1	100	100	100	White	O	O

Note: External control availability "O" means available.
"X" means unavailable.

Figure 3
FUNCTION TABLE

MODE 2 :

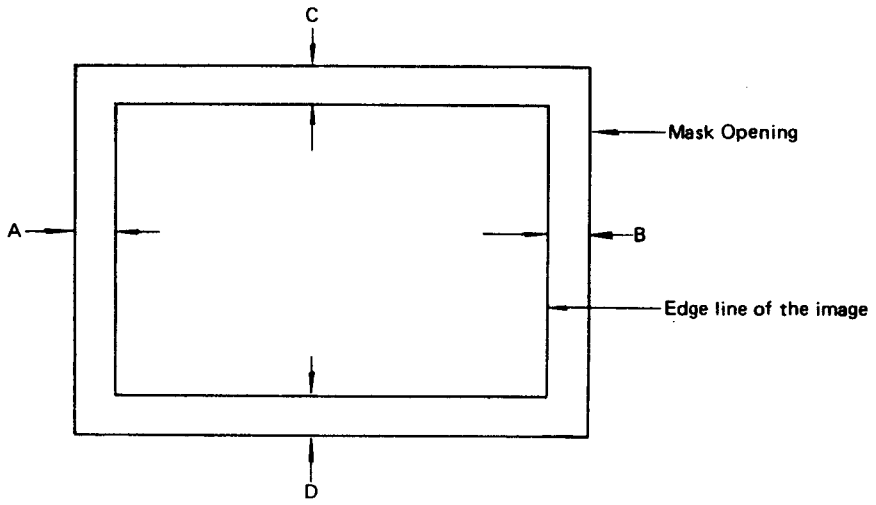
FUNCTION TABLE
(64 COLORS)

Vertical sync polarity
: Negative

No.	Input Video Signal						Relative Output Level			COLOR	Note	
	RB	GB	BB	RA	GA	BA	R%	G%	B%		cont.	Bri't
1	0	0	0	0	0	0	0	0	0	Black	X	X
2	0	0	0	0	0	1	0	0	66	L.L. Blue	X	O
3	0	0	0	0	1	0	0	66	0	L.L. Green	X	O
4	0	0	0	0	1	1	0	66	66	L.L. Cyan	X	O
5	0	0	0	1	0	0	66	0	0	L.L. Red	X	O
6	0	0	0	1	0	1	66	0	66	L.L. Magenta	X	O
7	0	0	0	1	1	0	66	66	0	L.L. Yellow	X	O
8	0	0	0	1	1	1	66	66	66	L.L. White	X	O
9	0	0	1	0	0	0	0	0	33	D. Blue	O	O
10	0	0	1	0	0	1	0	0	100	H.L. Blue	O	O
11	0	0	1	0	1	0	0	66	33		O	O
12	0	0	1	0	1	1	0	66	100		O	O
13	0	0	1	1	0	0	66	0	33		O	O
14	0	0	1	1	0	1	66	0	100		O	O
15	0	0	1	1	1	0	66	66	100		O	O
16	0	0	1	1	1	1	66	66	100		O	O
17	0	1	0	0	0	0	0	33	0	D. Green	O	O
18	0	1	0	0	0	1	0	33	66		O	O
19	0	1	0	0	1	0	0	100	0	H.L. Green	O	O
20	0	1	0	0	1	1	0	100	66		O	O
21	0	1	0	1	0	0	66	33	0		O	O
22	0	1	0	1	0	1	66	33	66		O	O
23	0	1	0	1	1	0	66	100	0		O	O
24	0	1	0	1	1	1	66	100	66		O	O
25	0	1	1	0	0	0	0	33	33	D. Cyan	O	O
26	0	1	1	0	0	1	0	33	100		O	O
27	0	1	1	0	1	0	0	100	33		O	O
28	0	1	1	0	1	1	0	100	100	H.L. Cyan	O	O
29	0	1	1	1	0	0	66	33	33		O	O
30	0	1	1	1	0	1	66	33	100		O	O
31	0	1	1	1	1	0	66	100	33		O	O
32	0	1	1	1	1	1	66	100	100		O	O
33	1	0	0	0	0	0	33	0	0	D. Red	O	O
34	1	0	0	0	0	1	33	0	66		O	O
35	1	0	0	0	1	0	33	66	0		O	O
36	1	0	0	0	1	1	33	66	66		O	O
37	1	0	0	1	0	0	100	0	0	H.L. Red	O	O
38	1	0	0	1	0	1	100	0	66		O	O
39	1	0	0	1	1	0	100	66	0		O	O
40	1	0	0	1	1	1	100	66	66		O	O
41	1	0	1	0	0	0	33	0	33	D. Magenta	O	O
42	1	0	1	0	0	1	33	0	100		O	O
43	1	0	1	0	1	0	33	66	33		O	O
44	1	0	1	0	1	1	33	66	100		O	O
45	1	0	1	1	0	0	100	0	33		O	O
46	1	0	1	1	0	1	100	0	100	H.L. Magenta	O	O
47	1	0	1	1	1	0	100	66	33		O	O
48	1	0	1	1	1	1	100	66	100		O	O
49	1	1	0	0	0	0	33	33	0	D. Yellow	O	O
50	1	1	0	0	0	1	33	33	66		O	O
51	1	1	0	0	1	0	33	100	0		O	O
52	1	1	0	0	1	1	33	100	66		O	O
53	1	1	0	1	0	0	100	33	0		O	O
54	1	1	0	1	0	1	100	33	66		O	O
55	1	1	0	1	1	0	100	100	0	H.L. Yellow	O	O
56	1	1	0	1	1	1	100	100	66		O	O
57	1	1	1	0	0	0	33	33	33	D. White	O	O
58	1	1	1	0	0	1	33	33	100		O	O
59	1	1	1	0	1	0	33	100	33		O	O
60	1	1	1	0	1	1	33	100	100		O	O
61	1	1	1	1	0	0	100	33	33		O	O
62	1	1	1	1	0	1	100	33	100		O	O
63	1	1	1	1	1	0	100	100	33		O	O
64	1	1	1	1	1	1	100	100	100	H.L. White	O	O

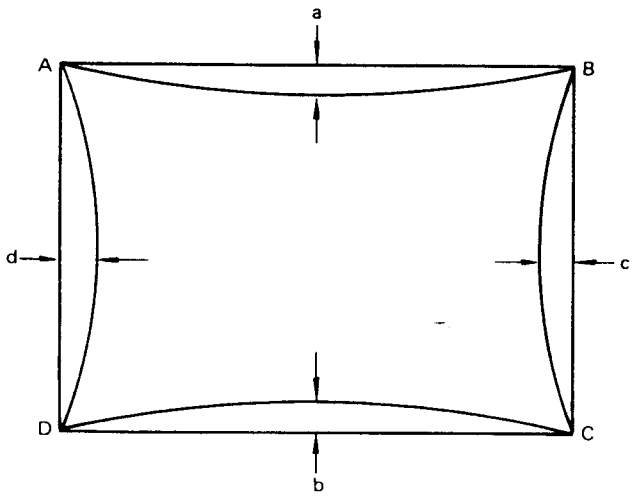
H.L. = High Light (Brighter)
L.L. = Low Light
D = Dark

Figure 4
FUNCTION TABLE



$|A - B| \leq 0.236''$ (6 mm)
$|C - D| \leq 0.236''$ (6 mm)

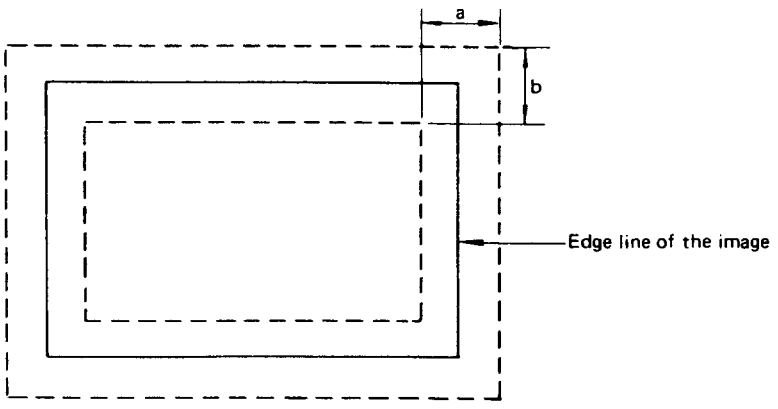
Figure 5
IMAGE POSITION



a, b $\leq$ 0.098" (2.5 mm)
c, d $\leq$ 0.098" (2.5 mm)

Figure 6
PINCUSHION ERROR

Rectangularness & Parallelogram distortion



a . . . . 0.157" (4 mm)
b . . . . 0.157" (4 mm)

Figure 7
PARALLELOGRAM DISTORTION

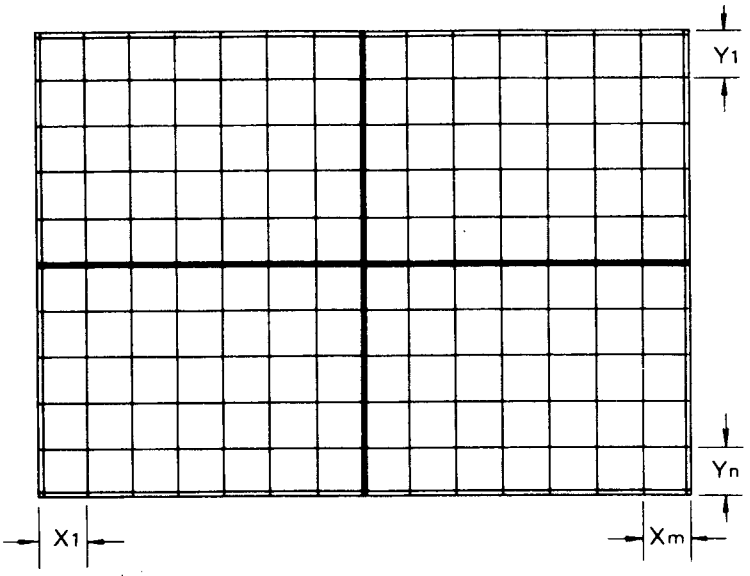


Figure 8
LINEARITY

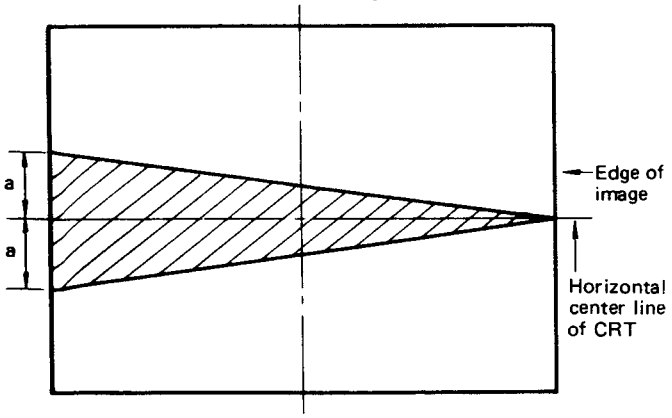
$$\text{HORIZONTAL LINEARITY} = \frac{X\,(MAX) - X\,(MIN)}{X\,(MAX) + X\,(MIN)} \times 100\,(\%) \leqq 7\%$$

$$\text{VERTICAL LINEARITY} = \frac{Y\,(MAX) - Y\,(MIN)}{Y\,(MAX) + Y\,(MIN)} \times 100\,(\%) \leqq 7\%$$

Maximum and minimum value should not be adjacent to each other

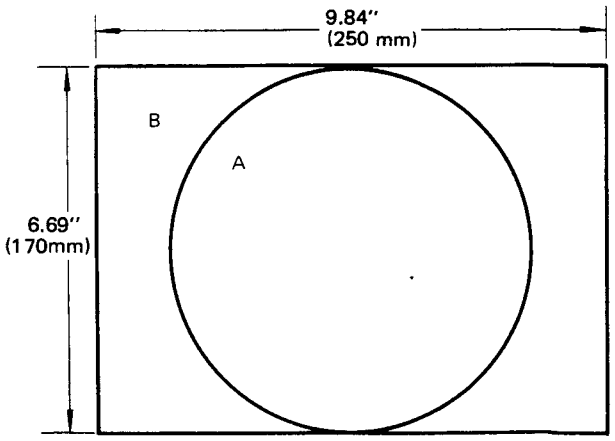
X (MAX) = Maximum distance between vertical lines from X1 to Xm
X (MIN) = Minimum distance between vertical lines from X1 to Xm
Y (MAX) = Maximum distance between horizontal lines from Y1 to Yn
Y (MIN) = Minimum distance between horizontal lines from Y1 to Yn

Horizontal center line of the image shall be within the shaded area in Figure 9.



a = 0.098" (2.5 mm)

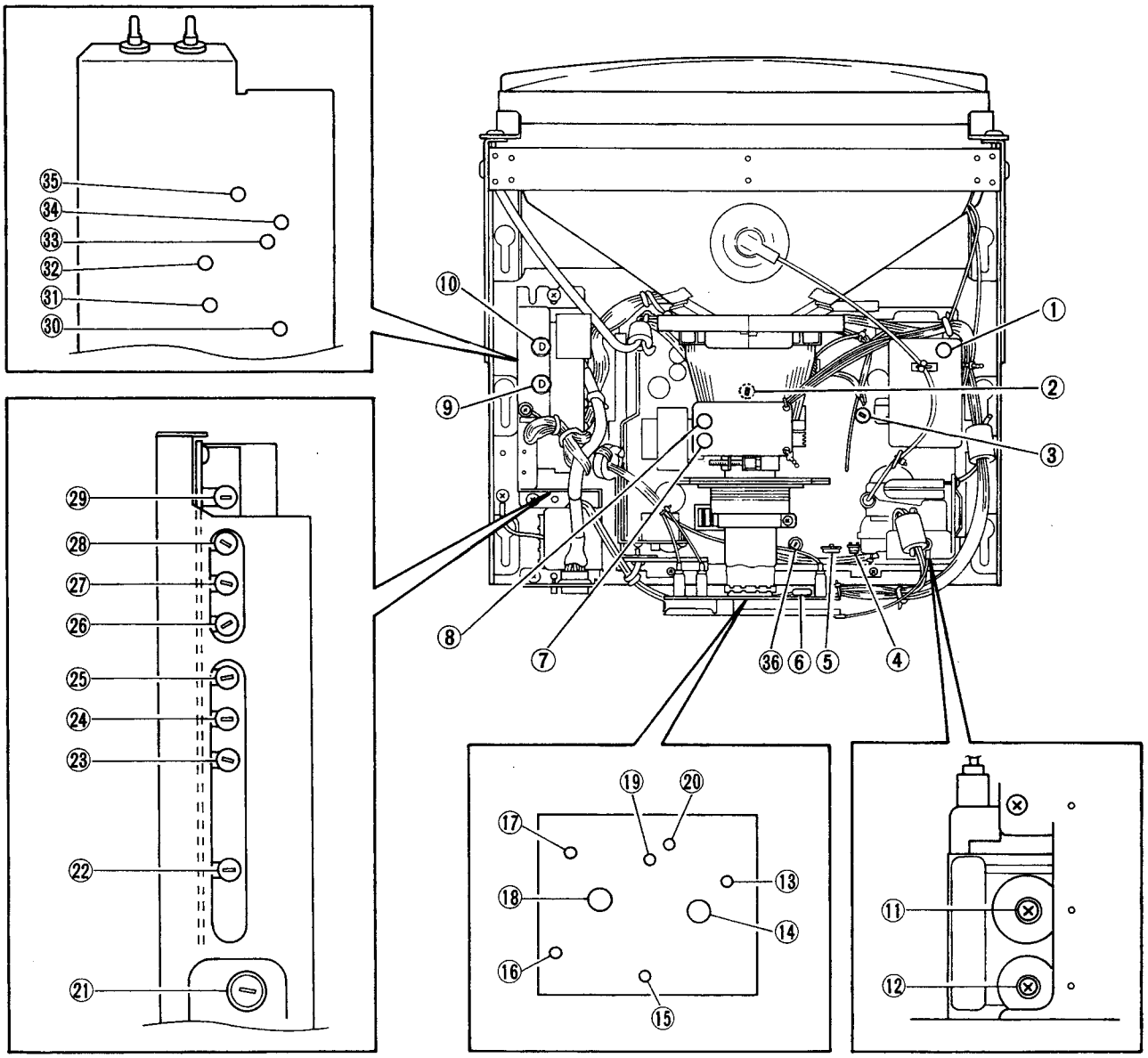
Figure 9
ROTATION



area A ≦ 0.0197" (0.5 mm)
area B ≦ 0.0276" (0.7 mm)

Figure 10
MIS-CONVERGENCE

CONTROL LOCATION



① ..... AVR (VR811)
② ..... SUB AVR (VR761)
③ ..... V. LIN (VR403)
④ ..... HEIGHT (VR402)
⑤ ..... V. CENTER (VR431)
⑥ ..... V. HOLD (VR401)
⑦ ..... AMP (VR451)
⑧ ..... TILT (VR452)
⑨ ..... BRIGHT (VR1302)
⑩ ..... CONTRAST (VR1301)
⑪ ..... FOCUS
⑫ ..... SCREEN
⑬ ..... B GAIN (VR331)
⑭ ..... TP86 (test point of 70V)
⑮ ..... G. LOW-LIGHT (VR352)
⑯ ..... G GAIN (VR321)
⑰ ..... R GAIN (VR311)
⑱ TP31
⑲ ..... R. LOW-LIGHT (VR351)
⑳ ..... B. LOW-LIGHT (VR353)
㉑ ..... M1 WIDTH (L1351)
㉒ ..... M1 HEIGHT (VR1363)
㉓ ..... M2 BRIGHT (VR1384)
㉔ ..... M1 BRIGHT (VR1383)
㉕ ..... M2 VPCC (VR1362)
㉖ ..... M1 VPCC (VR1361)
㉗ ..... M1 H. OSC (VR1352)
㉘ ..... M2 H. OSC (VR1353)
㉙ ..... Sub H.P.C (VR1351)
㉚ ..... B 1/3 GAIN (VR1332)
㉛ ..... B 2/3 GAIN (VR1331)
㉜ ..... R 2/3 GAIN (VR1311)
㉝ ..... R 1/3 GAIN (VR1312)
㉞ ..... CONT 1 (VR82)
㉟ ..... ABL (VR81)
㊱ ..... TP87 (test point of 62V)

DISASSEMBLY INSTRUCTIONS

CRT socket Board Removal (See Figure 1, 2 and 3)

1. Remove the ground wire terminal screws ①.
2. Remove the CRT socket board ② from the CRT.
   NOTE: 1. Cut silicone rubber ③ with knife.
   2. Be careful not to damage the CRT neck.
   3. Apply silicone again after replacing or checking the CRT socket board.
3. Disconnect RF cable connector R ④.
4. Disconnect RF cable connector B ⑤.
5. Disconnect RF cable connector G ⑥.
6. Desolder the shield plate nail ⑦ and remove the shield plate ⑧ from the CRT socket board.
7. Disconnect connector CN102B ⑨.
8. Desolder lead wire E2 ⑩.
9. Desolder lead wire G2 ⑪.
10. Cut the cord band ⑫.
11. Open the CRT socket cover ⑬.
12. Desolder focus lead wire ⑭.

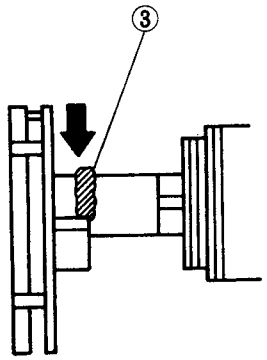


Figure 1

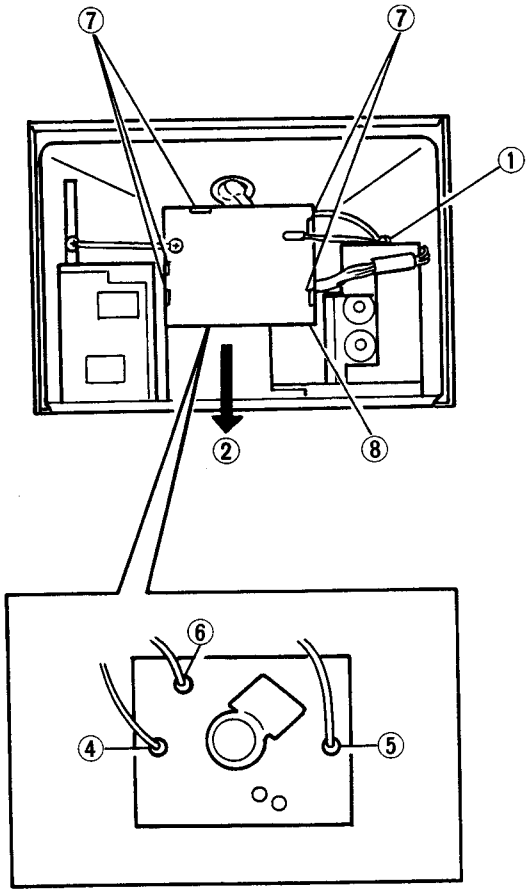


Figure 2

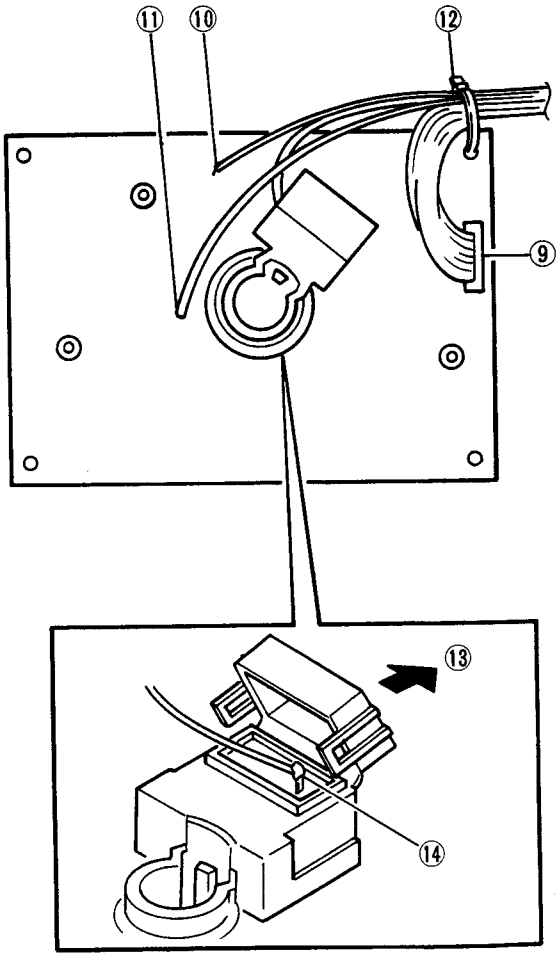


Figure 3

Interface Board and Line filter Board Removal (See Figure 4 and 5)

1. Remove the ground wire terminal screw ⑮.
2. Remove the interface bracket screws ⑯ from bottom plate.
3. Remove the cable clamp ⑰.
4. Remova the cable clamp ⑱.
5. Disconnect lead wire P5, P6 ⑲.
6. Disconnect lead wire P1, P2 ⑳.
7. Remove the screws ㉑ holding the line filter board.
8. Remove the connector shield case screws ㉒.
9. Disconnect connector J501 ㉓ and J502 ㉔.
10. Remove cord clamp ㉕.
11. Cut the cord band ㉖.
12. Disconnect connector J505 ㉗.
13. Disconnect connector J508 ㉘.
14. Disconnect connector J509 ㉙.
15. Disconnect connector J506 ㉚.
16. Remove the screws ㉛ holding the interface circuit board.

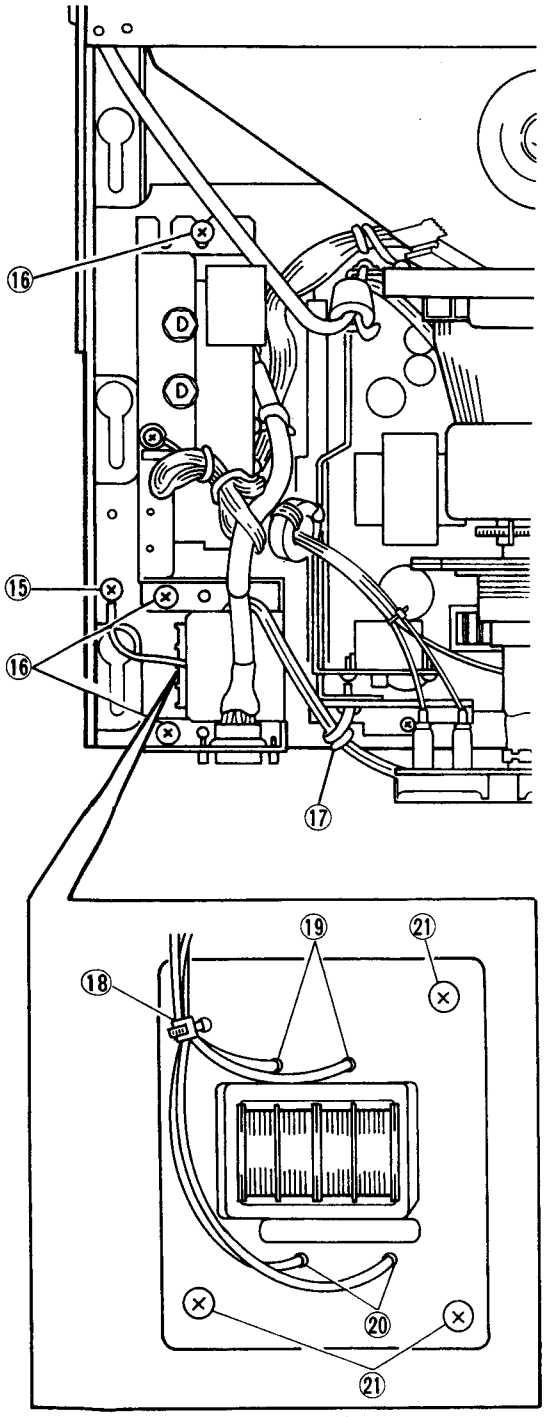


Figure 4

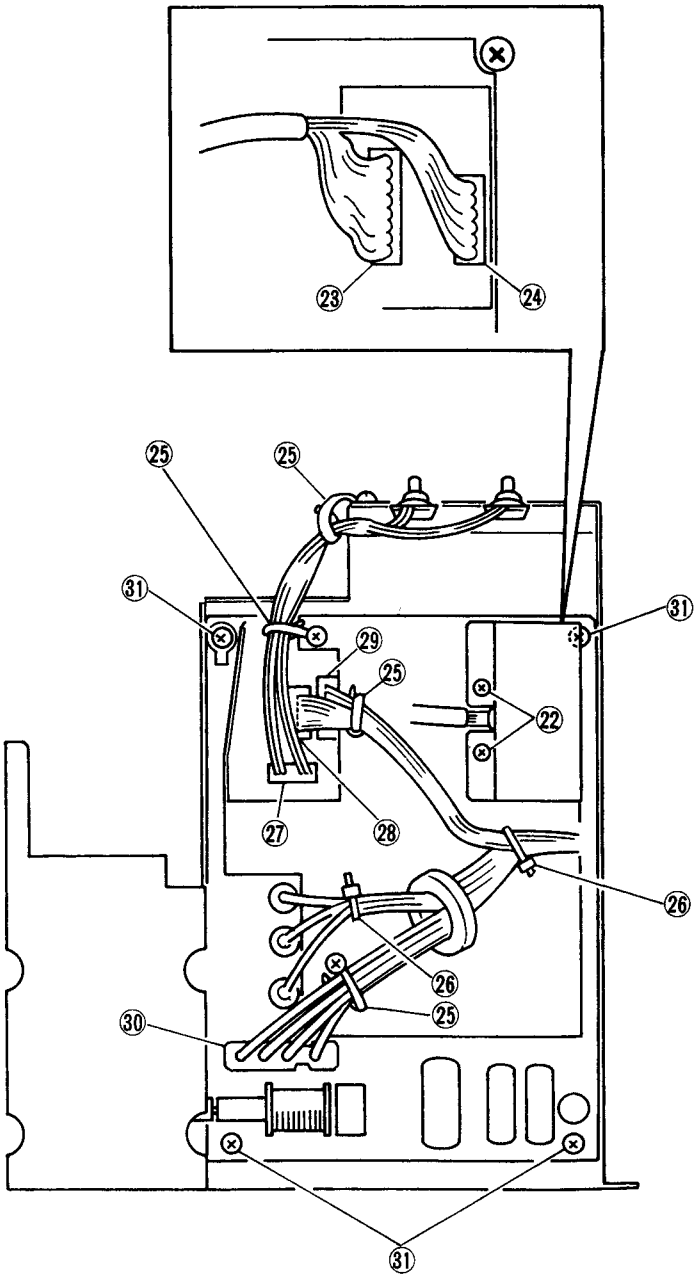


Figure 5

Main Board Removal (See Figure 6)

1. Remove the CRT socket board shown in "CRT socket Board Removal.
2. Remove the interface board show in "Interface board Removal".
3. Remove the cord clamp ㉜.
4. Disconnect degaussing coil connector CN107 ㉝.
5. Remove the ground wire terminal screw ㉞.
6. Remove anode lead ㉟ from clamper.
7. Remove the anode cap ㊱ from the CRT.
8. Remove the lead clamp ㊲.
9. Disconnect connector CN104 ㊳.
10. Remove screw ㊴ that fasten the P.C.B holders.
11. Remove the main circuit board ㊵.

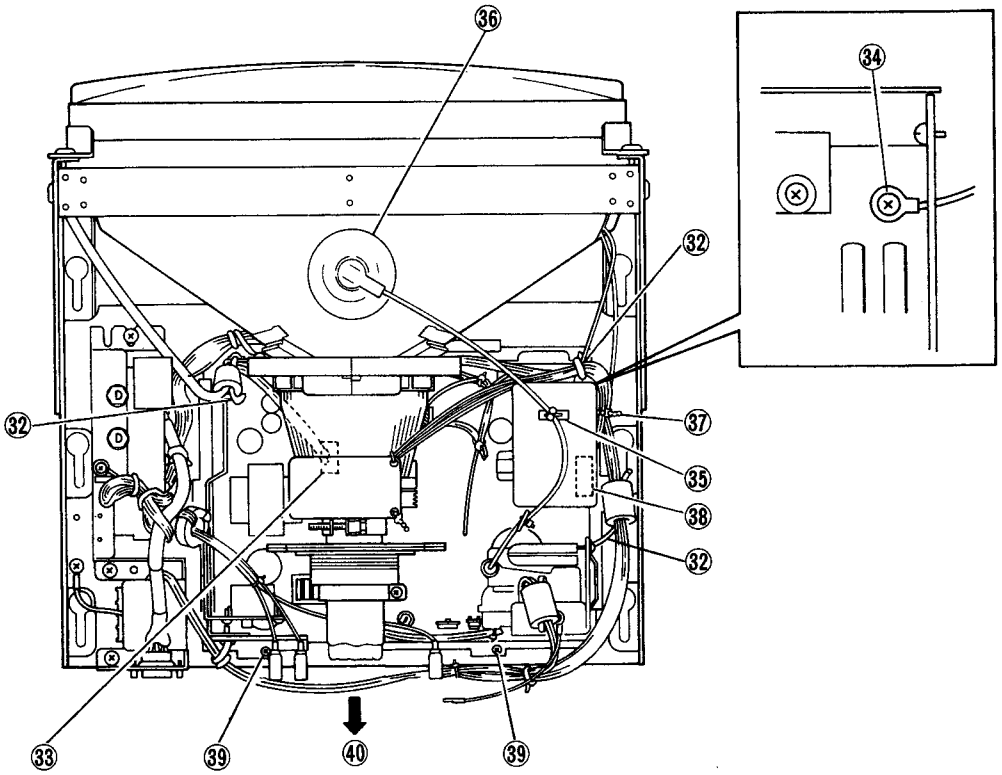


Figure 6

CRT Removal (See Figure 7)

1. Remove the CRT socket board shown in "CRT Socket Board Removal".
2. Remove the interface board shown in "Interface Board Removal".
3. Disconnect degaussing coil connector CN107.
4. Disconnect connector CN104 ㊳.
5. Desolder the ground wire ㉞.
6. Remove the anode cap ㊱ from the CRT.
7. Remove the hexagon bolt ㊶.

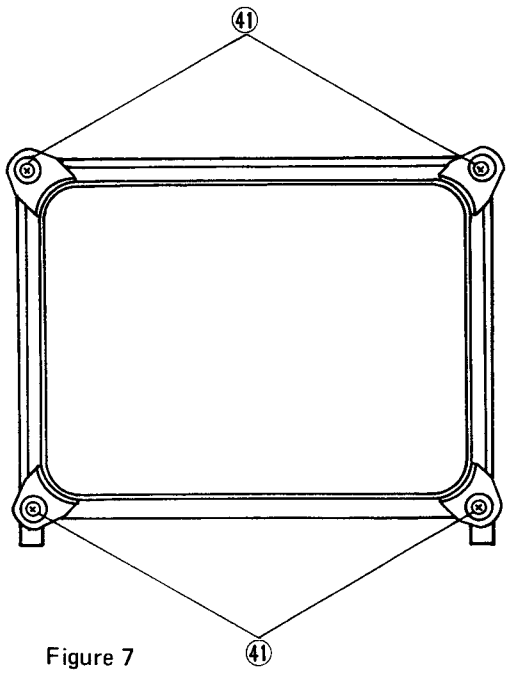


Figure 7

CAUTION FOR ADJUSTMENT AND REPAIR

1. Degaussing is required at purity adjustment or convergence adjustment.
2. At the factory a white balance meter is used. In this manual a simplified method is given.
3. If you check or adjust electrical specification or function, more than 20 minutes burn-in is required.
4. Observe proper lead dressing when reassembling the unit.

CAUTION FOR SERVICING

When servicing or replacing the CRT, high voltage sometimes remains on the anode. So, completely discharge high voltage before servicing or replacing the CRT so as to prevent a shock to the serviceman.

CRT Anode Discharge

1. When you check the CRT anode or replace the CRT, discharge the CRT anode to the external conductive coating (aquadag) of CRT, especially when checked right after power turn-off.
2. Ground one end of a jumper wire which has a resistor (30kV < resisting pressure 100MΩ) and connect the other point to the CRT anode.
   NOTE: Grounding must be done first.

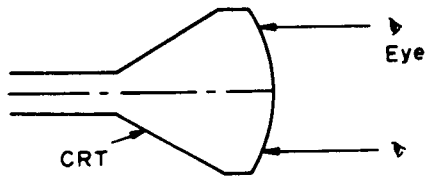
This model has a section that does not share a common ground with the power supply section. The different sections are referred to as the HOT section and the COLD section in the precautions below.

1. Do not touch the HOT section and the COLD section at the same time. You may receive an electric shock.
2. Do not short the HOT section to the COLD section. This could blow the fuse or damage parts.
3. Never measure the HOT section and the COLD section at the same time when using tools such as oscilloscopes or multimeters.
4. Always unplug the unit before beginning any operation such as removing the chassis.

ADJUSTMENT PROCEDURE

PRECAUTIONS

1. Follow all the standard conditions presented in this document.
2. Measure the image size, distortion, etc. horizontally on the CRT face.
3. Use a TV Color Analyzer II (Minolta) to measure the luminance and the color levels. Calibrate with the Gamma standards. Calibrate the zero levels before use.
4. Use a digital voltmeter rated for at least 10M OHM to measure the DC voltage.
5. The ambient illumination must be no greater than 10 lux.
6. During adjustment of brightness, the brightness figure is a value for the condition when the back cover is removed. When the back cover is mounted, the brightness is slightly raised.
7. When checking the adjustments, demagnetize with a degaussing coil.
8. Use a Helmholtz device to adjust this unit with no horizontal magnetic field and a vertical magnetic field of 0.5 Gauss. Inspect the unit under the same conditions.
9. Unless otherwise specified, adjustment and check should be mode under the standard condition.
10. To be sure image width, height and distortion proceed as below:



* Measure level with respect to tube axis.

11. Adjust coils by means of a hexagonal tuning tool (non-metalic).

STANDARD CONDITION OF ADJUSTMENT PROCEDURE

1. Timing :	Mode 2 timing (See page 5)
2. Input signal :	"H" character of full screen size High Light Green
3. Video level :	TTL level
4. Power source :	AC 120V 60Hz
5. Ambient temperature :	Room temperature
6. Warm up time :	More than 20 minutes
7. Brightness control :	Maximum
8. Contrast control :	Maximum
9. Magnetic field :	Vertical 0.5 Gauss Horizontal 0 Gauss

ADJUSTMENT PROCEDURE

1. Voltage adjustment

1) Connect a digital voltmeter between the TP1301 on the Interface board and ground.
2) Adjust VR811 (+B ADJ) to set the voltmeter to 62V.
3) Confirming the +70V, +40V and +8V
3)-1 +70V
Confirm the voltage across C861 is 70 ± 2V.
3)-2 +40V
Confirm the voltage across C863 is 40 ± 2V.
3)-3 +8V
Confirm the voltage across C864 is 8 ± 2V.

2. Vertical Hold adjustment

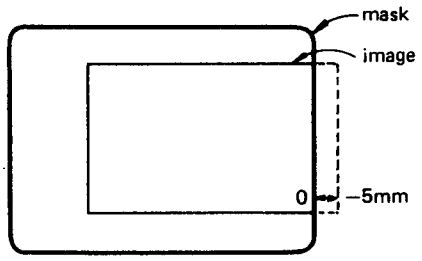
1) Turn off the V. SYNC signal.
2) Connect a frequency counter to white lead wire of deflection yoke and to ground.
3) Adjust VR401 (V. HOLD) to set the frequency to 48Hz.

3. Horizontal Hold adjustment

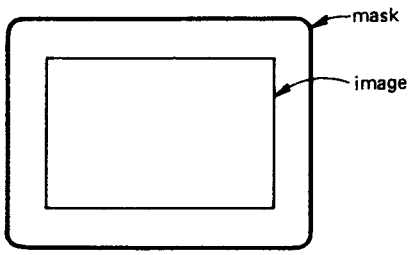
1) Turn off the H. SYNC signal.
2) Apply Mode 1 signal.
3) Adjust VR1352 (M1 H. OSC) to enable an image to rise. The setting range at this time should be such that the tilt of the image comes within 45 degrees to the left and right with the vertical line as a reference line.
4) Apply Mode 2 signal.
5) Adjust VR1353 (M2 H. OSC) to raise the image. The setting range at this time is such that the tilt of the image is within 45 degrees to the left and right with the vertical line as a reference line.

4. Horizontal Position adjustment

1) Apply Mode 2 signal.
2) Turn VR1351 (SUB H.P.C) clockwise to its extreme end.
3) Adjust SCREEN control and make raster faintly on the screen.
4) Switch the insertion position to bring the raster to come to the horizontal center of JS1307 (H. DC CENTERING SELECT CHIP). Commonly this is the position where a black lead is connected to F1 of JS1307 and an orange lead to F2.
5) Apply Mode 1 signal.
6) Turn VR1352 (M1 H. OSC) until the right end of picture becomes invisible behind the mask. (0 to –5 mm)



7) Adjust VR1351 (SUB H.P.C) and center "H" character picture horizontally on the screen.
8) Apply Mode 2 signal.
9) Adjust VR1353 (M2 H. OSC) and center "H" character picture horizontally on the screen.



10) Confirm that the horizontal position of the image remains unchanged even if either signal, Mode 1 or Mode 2, is applied.
If the position more or less changes, go back to step (5) and repeat the procedure once again.

5. Confirming the X-ray protection circuit

1) Apply a full high light white field signal.
2) Turn the SCREEN control, and confirm the shutdown operation.

6. Purity adjustment

Keep the convergence yoke and deflection yoke in the positions shown below during repair.

- Convergence yoke layout

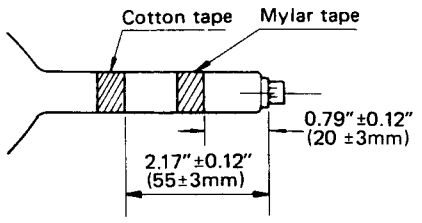
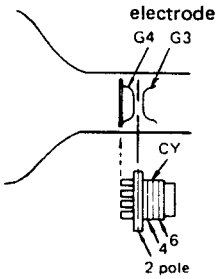


Fig. 1

1) Wind a cotton cloth tape or mylar tape around the CRT neck at the convergence yoke and deflection yoke positions on the new CRT to be installed.
(The tape should be applied to the extent of one turn +1 to 2 mm.)
2) After temporarily securing DY to the CRT mount CY at the location.
3) Mount the convergence yoke so that the center of the purity magnet (2-pole magnet) is between electrode G3 and electrode G4 of the CRT. Temporarity mount the deflection yoke.



Adjustment procedure

1) Demagnetize the CRT and the whole CRT display using a degaussing coil.
2) Apply a white crosshatch pattern signal.

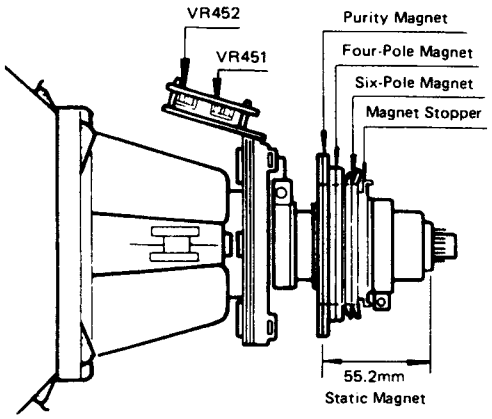


Fig. 2 Arrangement of the parts

3) Loosen the convergence yoke magnet stopper. Make a rough adjustment of CRT center convergence. (Refer to the description of convergence adjustments in a subsequent paragraph.)
4) Apply a full green field signal.
5) Push the deflection yoke toward the front of the CRT (to the funnel.)

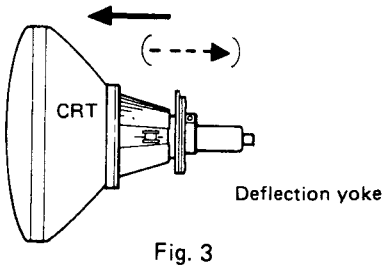


Fig. 3

6) Adjust the purity magnet so that the fire of Green can come in center of the screen.

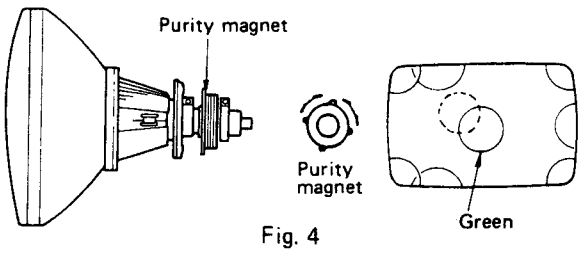


Fig. 4

7) Apply input signals R and B, and check that each appears in the center of the screen.
Fasten the magnet stopper.
8) Apply a green input signal. When the deflection yoke is pulled toward the rear, the fire ball grows larger and the whole screen turns green.

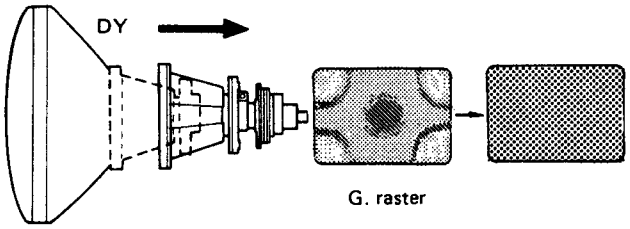


Fig. 5

9) The whole screen remains green. When the deflection yoke is further pulled toward the rear, the whole screen shows other colors besides green until it appears the same as when the deflection yoke is located at the front.

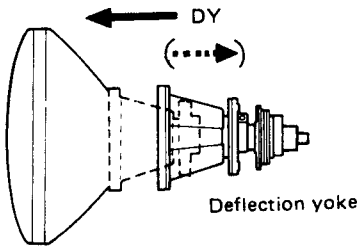


Fig. 6

10) Move down the section of the deflection yoke in which the whole screen is green, and fasten the deflection yoke in the center of that section.
* If warm-up time is not enough, the deflection yoke should be set slightly rearward from the purity center. If warm-up time is enough, fasten the deflection yoke slightly forward from the center.

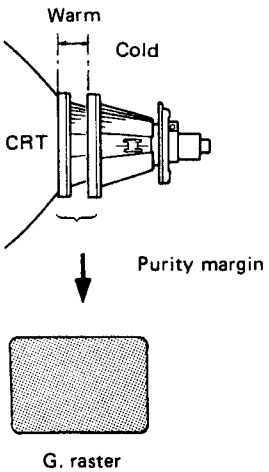


Fig. 7

11) Apply red, blue, and white signals alternately, and check that there is no purity mismatching. Confirm purity in each direction by rotating the set to direction of East, West, South and North after demagnetize by external degaussing coil.
* If mismatching is found, readjust by repeating Step 1) onward.

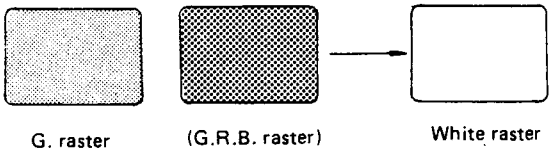


Fig. 8

7. Convergence adjustment

1) Apply the mixed cross-hatch pattern of Red and Blue (Magenta) with the computer.
2) Loosen the magnet stopper.
3) Match the red and blue at screen center with the four-pole magnet (Rotate the two-ring magnets so that the red and blue beams move in opposite circular direction.).

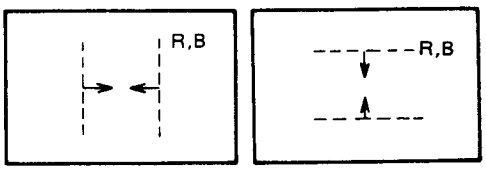


Fig. 9 4-pole static magnet

4) Apply a tri-color (red, green, blue), compound pattern (screen white).
5) Match the R, G, B at the center of the screen by the 6-pole magnet.

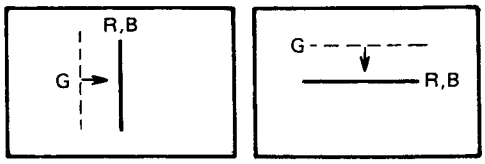


Fig. 10 6-pole static magnet

6) After adjustment the magnet stopper must be tightened.
7) Adjustment of edge convergence
A) 1. Loosen the deflection yoke fixing screw a little.
2. Move the deflection yoke upwards, downwards, to the left and right as shown in the figures below. Adjust the aberrations in Fig. 11 and Fig. 12 so that the overall convergence becomes better.

● Upward/downward

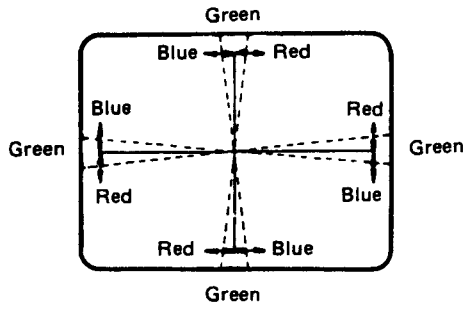
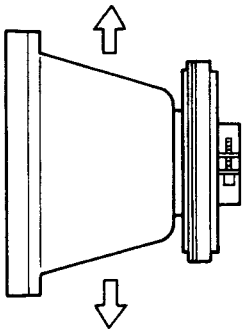


Fig. 11



Picture 1
(Side view)

● To the left and right

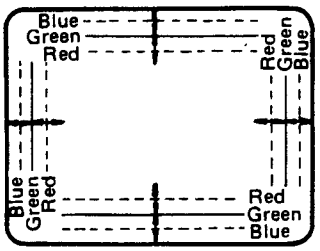
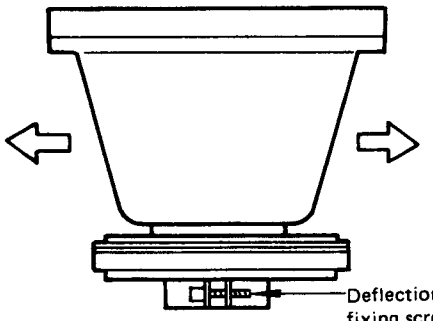
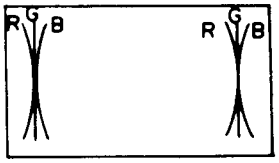


Fig. 12



Picture 2 (Top view)

3. Adjust the convergence of the fringe area (four corners), using VR451 and VR452.



4. After adjustment, insert a wedge as shown in Fig. 13 and tighten the deflection yoke fixing screw.

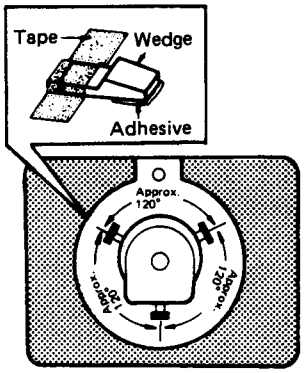


Fig. 13 Position where the wedge is inserted and attachment of tape

B) Insert a permalloy through the four corners of the deflection yoke and fix it when the convergence becomes better.

8. White balance, CRT cut-off & Brightness adjustment

1) Turn VR1301 (CONTRAST) clockwise to its extrame end.
2) Turn VR1302 (BRIGHTNESS) clockwise to its extrame end.
3) Turn VR351, VR352 and VR353 (LOW-LIGHT) counterclockwise to their extrame ends.
4) Set VR1311 and VR1331 (2/3 GAIN) to its center position.
5) Set VR1312 and VR1332 (1/3 GAIN) to its center position.
6) Turn off the video signal only.
7) Turn the SCREEN control clockwise. Also turn the LOW-LIGHT control of the first lit colorfully clockwise.

8) Further, turn the SCREEN control clockwise and turn the LOW-LIGHT control of the second lit color fully clockwise.
9) Turning the SCREEN control, set it to the point where the last lit color barely lights.
10) Turn the LOW-LIGHT control of the first lit and second lit colors until the raster is whitened.
Note:
The brightness in steps (7) to (10) should be made darker as much as possible until it comes to have something to do with the color tracking and adjustment thereafter.
11) Turn the SCREEN control clockwise to the point at which the raster and flyback line disappears.
12) Connect a digital voltmeter provided with a high impedance probe (1GΩ), between the test point (TP31) of the CRT G2 and ground and measure G2 voltage. Then, turn the SCREEN control to the extent of −5V, there by reducing G2 voltage. After this remove the probe.
13) Apply Mode 1 signal.
14) Apply a light gray window signal. (54 mm high x 79 mm width area illuminated in center of screen) (Turn on the RA, GA and BA).
15) Adjust VR1383 (M1 BRIGHT) to set the luminance to 90 cd/m^2 (26.28 ft-L).
16) Adjust VR1311 (2/3 RED) and VR1331 (2/3 BLUE) to set the chromaticity coordinates to X = 0.281 and Y = 0.311.
17) Set luminance to 5 cd/m^2 (1.5 ft-L) using VR-1302 (BRIGHTNESS), and confirm if chromaticity coordinates are in the range of approximately X = 0.281 ± 0.015 and Y = 0.311 ± 0.015. If they are out of the above range, go to step 7) and repeat adjustments.
18) Apply a dark gray window signal (54 mm high x 79 mm width area illuminated in center of screen) (Turn on the GB).
19) Adjust VR1382 (CONT 1) to set the luminance to 90 cd/m^2 (26.28 ft-L).
20) Adjust VR1312 (1/3 RED) and VR1332 (1/3 BLUE) to set the chromaticity coordinates to X = 0.281 and Y = 0.311.
21) If the standard level cannot be secured, adjust the LOW-LIGHT control again.
(CONTRAST MAX, BRIGHTNESS 5 cd/m^2 (1.5 ft-L)).
22) If the standard level cannot be secured by applying a white signal (54 mm high x 79 mm width area illuminated in center of screen) (Turn on the RA, GA, BA and GB), adjust the LOW-LIGHT control again.
(CONTRAST MAX, BRIGHTNESS MIN)
23) Apply a full white field signal. (Turn on the RA, GA, BA and GB).
24) Adjust VR1381 (ABL) to set the luminance to 110 cd/m^2 (32.12 ft-L).
25) Apply Mode 2 signal.
26) Apply low light white window signal (54 mm high x 79 mm width area illuminate in center of screen) (Turn on the RA, GA and BA).
27) Adjust VR1384 (M2 BRIGHT) to set the luminance to 110 cd/m^2 (32.12 ft-L).

9. Image distortion adjustment

1) Apply Mode 1 signal.
2) Apply a green cross-hatch signal.
3) Best the vertical linearity of the image by adjusting VR403 (V. LIN).
4) Adjust VR1361 (M1 V. PCC) to straight the pincushion distortion of both sides.
5) Apply Mode 2 signals.
6) Adjust VR1362 (M2 V. PCC) to straight the pincushion distortion of both sides.

10. Width and Height of the image adjustment

1) Apply Mode 2 signal.
2) Apply signal of "H" character of full screen size (Green).
3) Adjust L551 (H. WIDTH) to set the width of the image to 9.84" (250 mm).
4) Adjust VR402 (HEIGHT) to set the height of the image to 6.69" (170 mm).
5) Apply Mode 1 signal.
6) Adjust L1351 (M1 WIDTH) to set the width of the image to 9.84" (250 mm).
7) Adjust VR1363 (M1 HEIGHT) to set the height of the image to 6.69" (170 mm).

11. Vertical Position adjustment

1) Apply Mode 1 signal.
2) Adjust VR431 (V. CENTER) to center the display image vertically.

12. Confirming the level of gradation

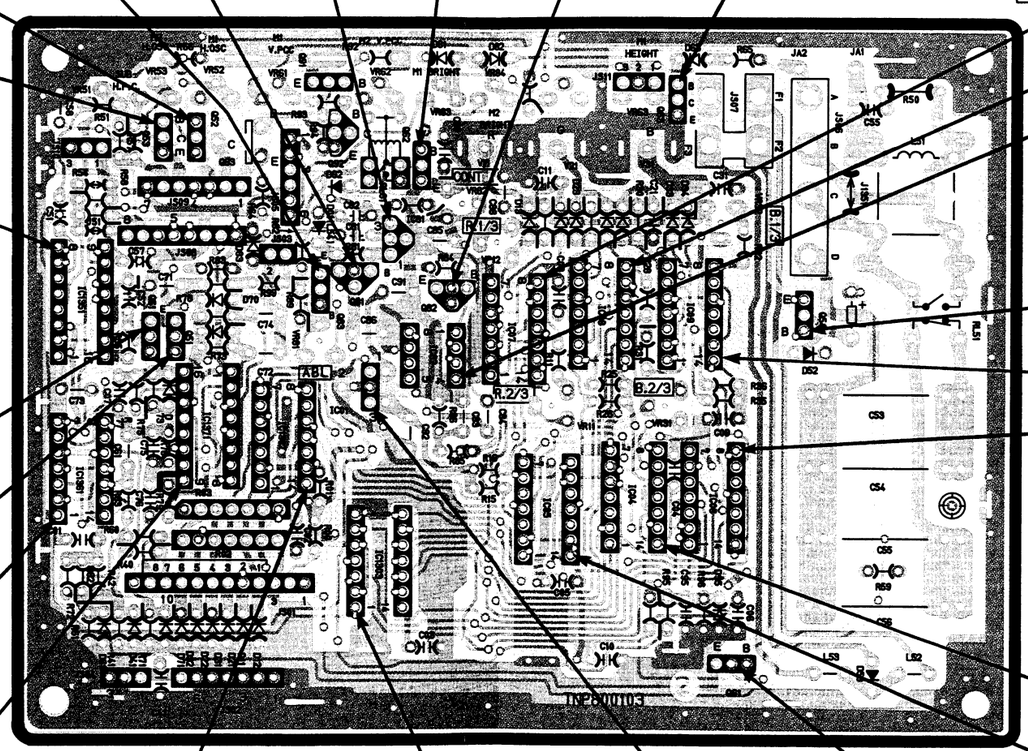
1) Apply Mode 1 signal.
2) Apply a full white field signal.
3) Check that each brightness level is the same under the conditions of the three items mentioned below.
   (A) Input RA, GA, BA, and INT signals, and turn the BRIGHT VR to the maximum position and the CONTRAST VR to the minimum position.
   (B) Input RA, GA, and BA signals only, and turn both the BRIGHT VR and the CONTRAST VR to the maximum position.
   (C) Input the INT signal only, and turn both the BRIGHT VR and CONTRAST VR to the maximum position.
   - When only the INT signal is input and the BRIGHT VR turned to the maximum position and the CONTRAST VR to the minimum position, the image (all white) must disappear.
4) Apply the Mode 2 signal.
5) Apply full white field signals.
   Check that each brightness level is the same under the conditions of the three items mentioned below.
   (A) Input RA, GA, BA, RB, GB, and BB signals, and turn the BRIGHT VR to the maximum position and the CONTRAST VR to the minimum position.
   (B) Input RA, GA, and BA signals only, and turn both the BRIGHT VR and CONTRAST VR to the maximum position.
   (C) Input RB, GB, and BB signal only, and turn both the BRIGHT VR and CONTRAST VR to the maximum position.
   - When the RB, GB, and BB signals are input and the BRIGHT control turned to the maximum position and the CONTRAST VR to the minimum position, the image (all white) must disappear.

13. Focus adjustment

1) Apply signal of "H" character of full screen size.
2) Focus Red, Green, Blue and White pictures to the shapest on the whole screen with FOCUS control.
3) Lock the FOCUS control with lacquer coating.

CONDUCTOR VIEW

Interface Board (TNP800103)



Q1383	
E	3.33V
C	1.55V
B	2.26V

Q1381	
E	7.94V
C	BRIGHT MAX. 3.33V
B	7.33V

IC1381	
1	7.33V
2	0V
3	1.25V

Q1362	
E	0V
C	8.00V
B	0.09V

Q1382	
E	7.94V
C	3.25V
B	7.32V

Q1363	
E	0V
C	0.15V
B	−0.17V

IC1307	
1	3.11V
2	4.94V
3	0.53V
4	4.94V
5	3.10V
6	0.50V
7	0V
8	0.30V
9	3.10V
10	3.11V
11	3.12V
12	0.78V
13	4.94V
14	4.94V

IC1308	
1	3.07V
2	3.06V
3	0.30V
4	3.05V
5	4.94V
6	0.46V
7	0V
8	0.47V
9	3.12V
10	4.94V
11	0.48V
12	0.10V
13	3.51V
14	4.94V

Q1352	
E	0V
C	0.013V
B	4.85V

Q1353	
E	12.80V
C	12.81V
B	0.013V

IC1351	
1	0V
2	4.05V
3	4.94V
4	4.52V
5	0.39V
6	4.58V
7	0.89V
8	0V
9	4.51V
10	4.94V
11	4.94V
12	4.05V
13	0.46V
14	4.51V
15	0.78V
16	4.94V

IC1382	
1	7.32V
2	1.99V
3	1.99V
4	0V
5	0.69V
6	0.66V
7	6.87V
8	7.94V

Q1354	
E	0V
C	0.08V
B	4.85V

IC1309	
1	4.40V
2	4.94V
3	0.29V
4	3.04V
5	4.94V
6	0.49V
7	0V
8	0.48V
9	3.10V
10	4.94V
11	0.30V
12	3.10V
13	3.10V
14	4.93V

IC1306	
1	−0.02V
2	0.09V
3	4.94V
4	0.09V
5	0.76V
6	3.10V
7	0V
8	3.10V
9	4.38V
10	0.77V
11	3.10V
12	0.74V
13	4.94V
14	4.94V

Q1360	
E	0V
C	0.22V
B	4.81V

Q1351	
E	0V
C	8.02V
B	0.10V

IC1361	
1	0V
2	4.10V
3	4.85V
4	0.11V
5	4.94V
6	4.81V
7	0V
8	4.51V
9	0.5V
10	4.94V
11	0.11V
12	4.10V
13	4.14V
14	4.94V

IC1371	
1	0V
2	5.15V
3	5.16V
4	4.61V
5	0.10V
6	0V
7	1.32V
8	0V
9	0.11V
10	5.16V
11	5.15V
12	4.60V
13	0.11V
14	0V
15	1.91V
16	5.16V

IC1302	
1	0.88V
2	4.94V
3	0.77V
4	0.86V
5	4.94V
6	0.80V
7	0V
8	0.78V
9	0.88V
10	4.94V
11	0.77V
12	0.82V
13	4.94V
14	4.94V

IC1303	
1	0.82V
2	4.94V
3	0.81V
4	0.85V
5	4.94V
6	0.78V
7	0V
8	0.10V
9	0.09V
10	0.80V
11	3.32V
12	3.03V
13	3.02V
14	4.94V

IC1301	
1	7.95V
2	0V
3	4.94V

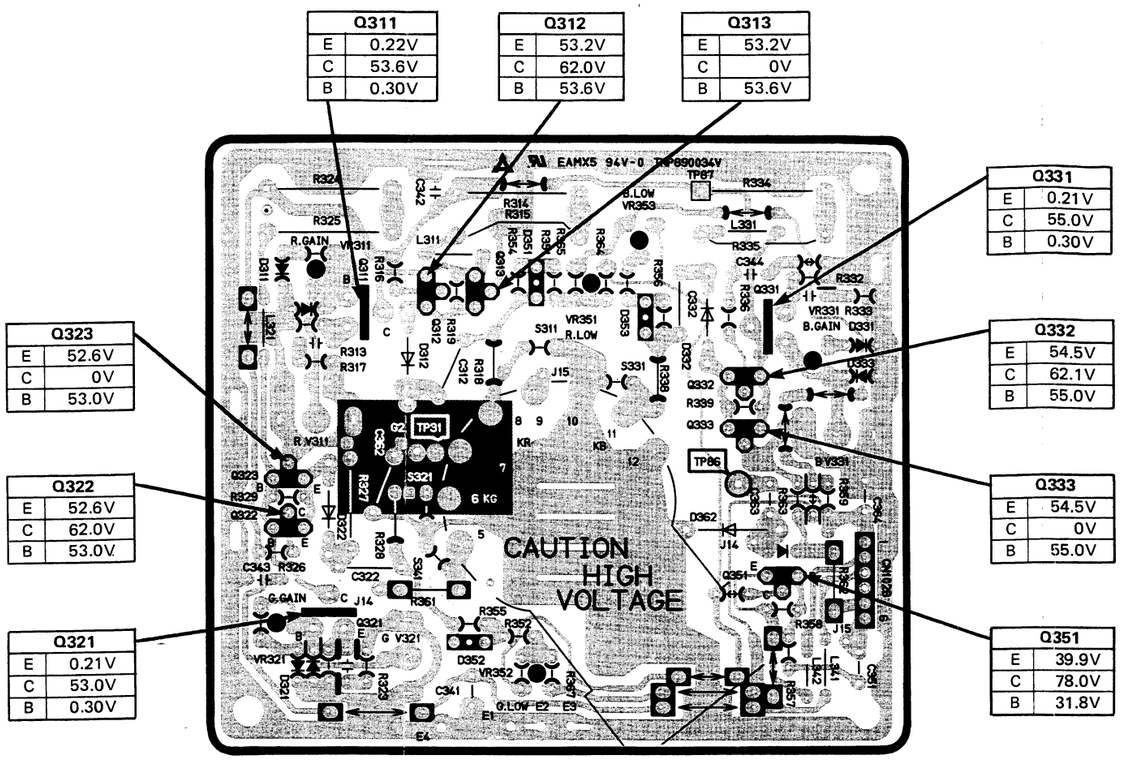
Q1361	
E	0V
C	0.09V
B	4.85V

IC1305	
1	0.77V
2	4.94V
3	3.12V
4	0.75V
5	4.38V
6	3.11V
7	0V
8	3.10V
9	0.09V
10	0.76V
11	3.10V
12	0.76V
13	4.94V
14	4.94V

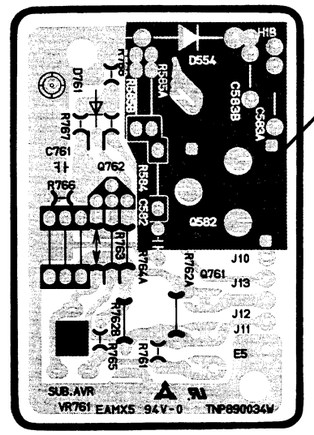
IC1304	
1	0.77V
2	3.10V
3	0V
4	3.09V
5	0.09V
6	4.38V
7	0V
8	4.38V
9	4.94V
10	4.94V
11	0V
12	4.94V
13	0.09V
14	4.94V

: Solder side pattern
: Parts side pattern

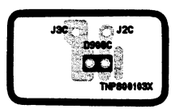
CRT Socket Board (TNP890034V)



HV Control Board (TNP890034W)



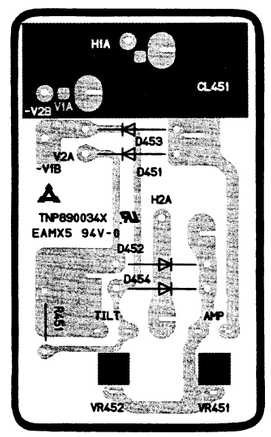
LED Board (TNP800103X)



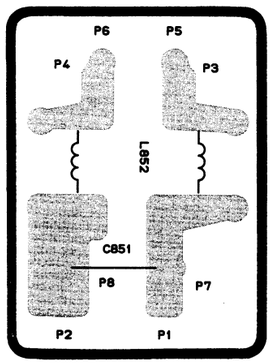
Interface board and LED board are supplied as a complex P.C.B (TNP800103-31) for the spare parts.

■ : Double Masking
▒ : Solder side pattern

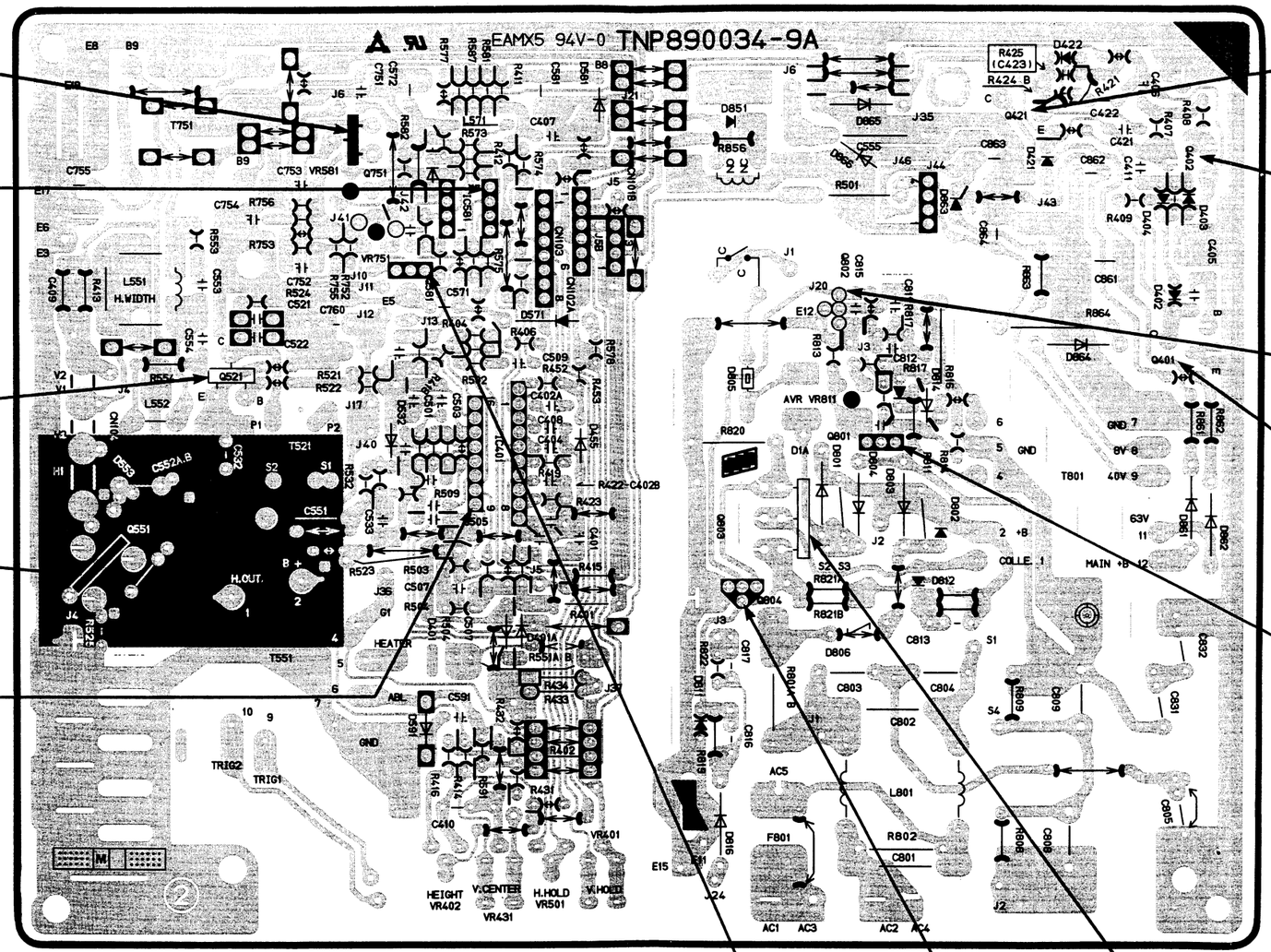
Convergence Board (TNP890034X)



Line Filter Board (TNP89503)



Main Board (TNP890034)



Q751	
E	1.67V
C	8.0V
B	2.24V

IC581	
1	0.53V
2	2.55V
3	0.09V
4	0V
5	0V
6	4.61V
7	0.10V
8	8.0V

Q521	
E	0V
C	51.5V
B	0.37V

Q551	
E	0V
C	62.2V
B	−0.18V

IC401	
1	0.7V
2	4.19V
3	7.29V
4	4.02V
5	12.0V
6	4.72V
7	4.31V
8	1.21V
9	8.74V
10	12.1V
11	3.64V
12	7.75V
13	6.78V
14	12.8V
15	1.55V
16	0.02V
17	0.24V
18	0V

Q421	
E	5.2V
C	82.0V
B	5.0V

Q402	
E	21.9V
C	40.4V
B	22.2V

Q802	
E	0.10V
C	0V
B	0.25V

Q401	
E	0V
C	21.0V
B	0.60V

Q801	
E	−4.23V
C	−2.0V
B	−3.62V

Q581	
E	0.02V
C	8.0V
B	0.52V

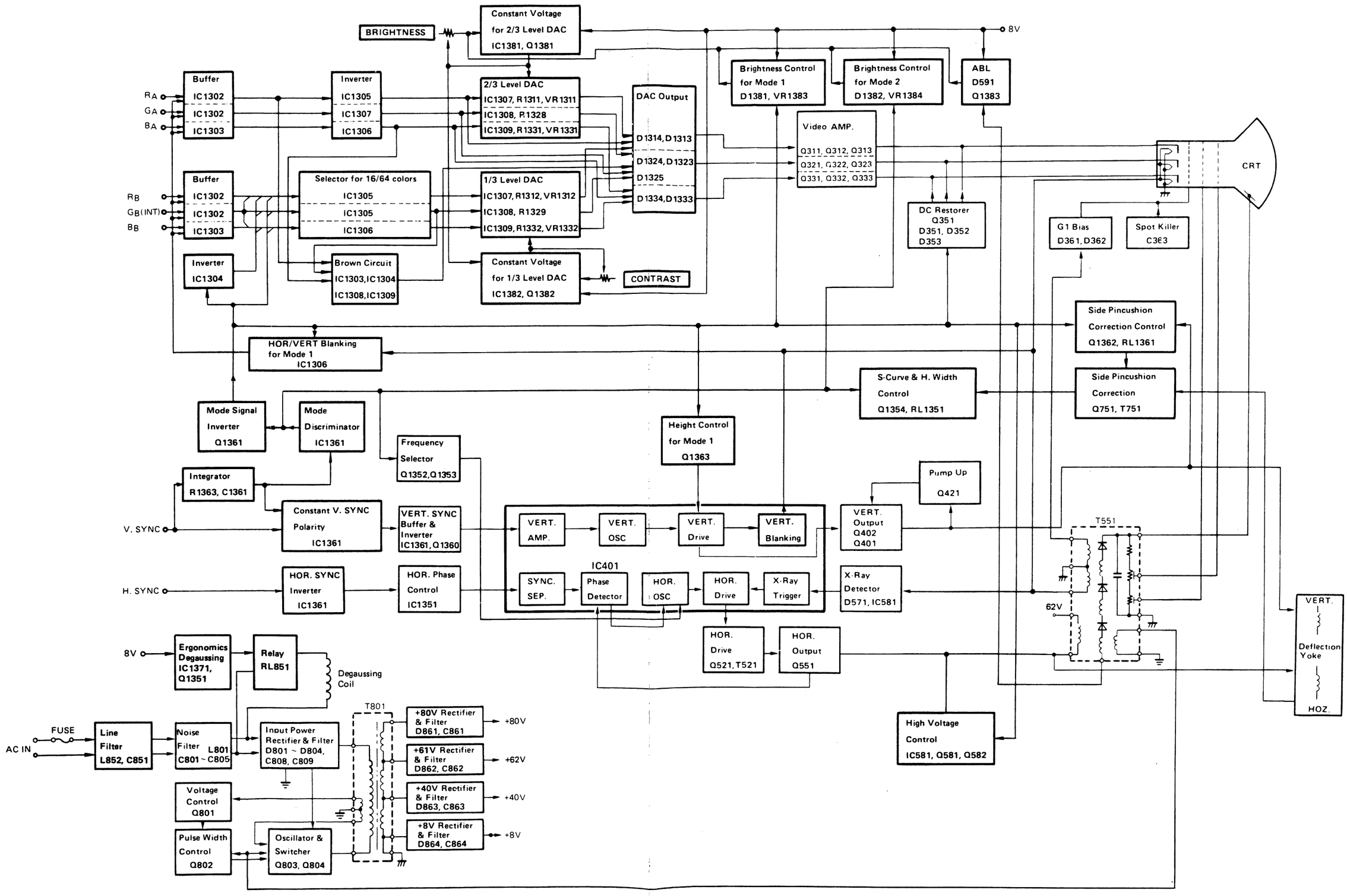
Q804	
E	0V
C	0.25V
B	0.08V

Q803	
E	0.08V
C	278V
B	0.25V

Main board, Convergence board, HV control board and CRT socket board are supplied as a complex P.C.B (TNP890034-32) for the spare parts.

■ : Double Masking

BLOCK DIAGRAM



SCHEMATIC DIAGRAM FOR MODEL TX-1440A

IMPOTANT SAFETY NOTICE

The component identified by shading or international symbol ⚠ on this schematic diagram incorporates special features impotant for protection from X-Radiation, fire and electrical shock hazards. When servicing it is essential that only manufacturer's specified parts be used for those critical components.

NOTES :

1. RESISTOR

All resistors are carbon 1/4W resistor, unless otherwise noted by the following marks.
Unit of resistance is ohm (Ω), (K = 1,000, M = 1,000,000).

- Ⓕ : Non Flammable
- ⊠ : Metal Oxide
- ◪ : Wire Wound
- ⊗ : Fusible
- △ : Solid
- ◎ : Metal (Precision and high stability)
- —▭— : Thermistor
- —▭— : Positive coefficient Thermistor

2. CAPACITOR

All capacitors are ceramic 50V capacitor, unless otherwise noted by the following marks.
Unit of capacitance is μF, unless otherwise noted.

- ⁺‖⁻ : Electrolytic
- Ⓣ : Tantalum
- (NP) : Bipolar
- Z : Z Type
- Ⓜ : Polyester
- ⓜ : Metalized Polyester
- ⊠ : Polypropylene

3. COIL

Unit of inductance is μH, unless otherwise noted.

4. VOLTAGE MEASUREMENT

Voltage is measured by a digital meter with DC 10M OHM/V receiving normal signal.

5. This schematic diagram is the letest at the time of printing and is subject to change without notice.

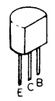
SERVICE NOTES :

This model has a section that does not share a common ground with the power supply section. The different sections are referred to as the HOT section and the COLD section in the precautions below.

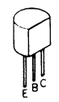
1. Do not touch the HOT section and the COLD section at the same time. You may receive an electric shock.
2. Do not short the HOT section to the COLD section. This could blow the fuse or damage parts.
3. Never measure the HOT section and the COLD section at the same time when using tools such as oscilloscopes or multimeters.
4. Always unplug the unit before beginning any operation such as removing the chassis.

TRANSISTOR, IC & DIODE TERMINAL GUIDE

2SC1360
2SC1384
2SC1573AH
2SC2851
2SC3526H



2SA564A
2SA720
2SA722
2SA838
2SA1123
2SC828A
2SC1215
2SC1317
2SC1318
2SA1145



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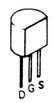
2N5401



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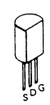

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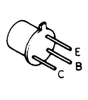
2SK192A



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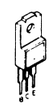
2SC1707AH

2SC3060
2SC3061
2SC3719
2SC3720



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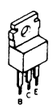
2SD1264
2SD1272
2SD1273
2SD1275



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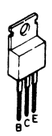

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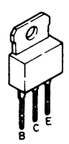

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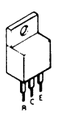

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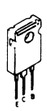
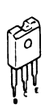


2SC3425

2SC2923



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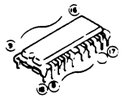
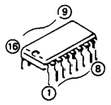
2SC3210

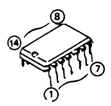
2SB641
2SD636
2SD639



HA11423



MB3759M
M74LS221P
M74LS123P



MN74HC04
DN74LS86
SN74LS86
M53321
SN74121
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SN74S00
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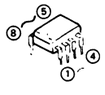
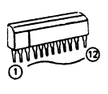


AN6562



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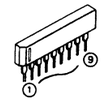

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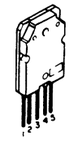
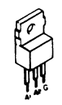


STR12006



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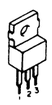

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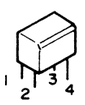
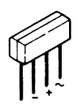
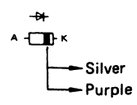
AN78M12



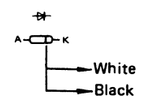
ON3105



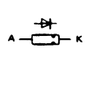
RB154



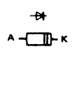
silver
..... 20E10
purple
..... 10E2



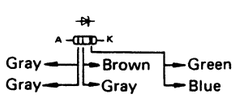
white
..... MA150
black
..... MA162



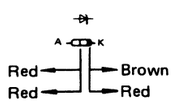
11DQ03



15DF6

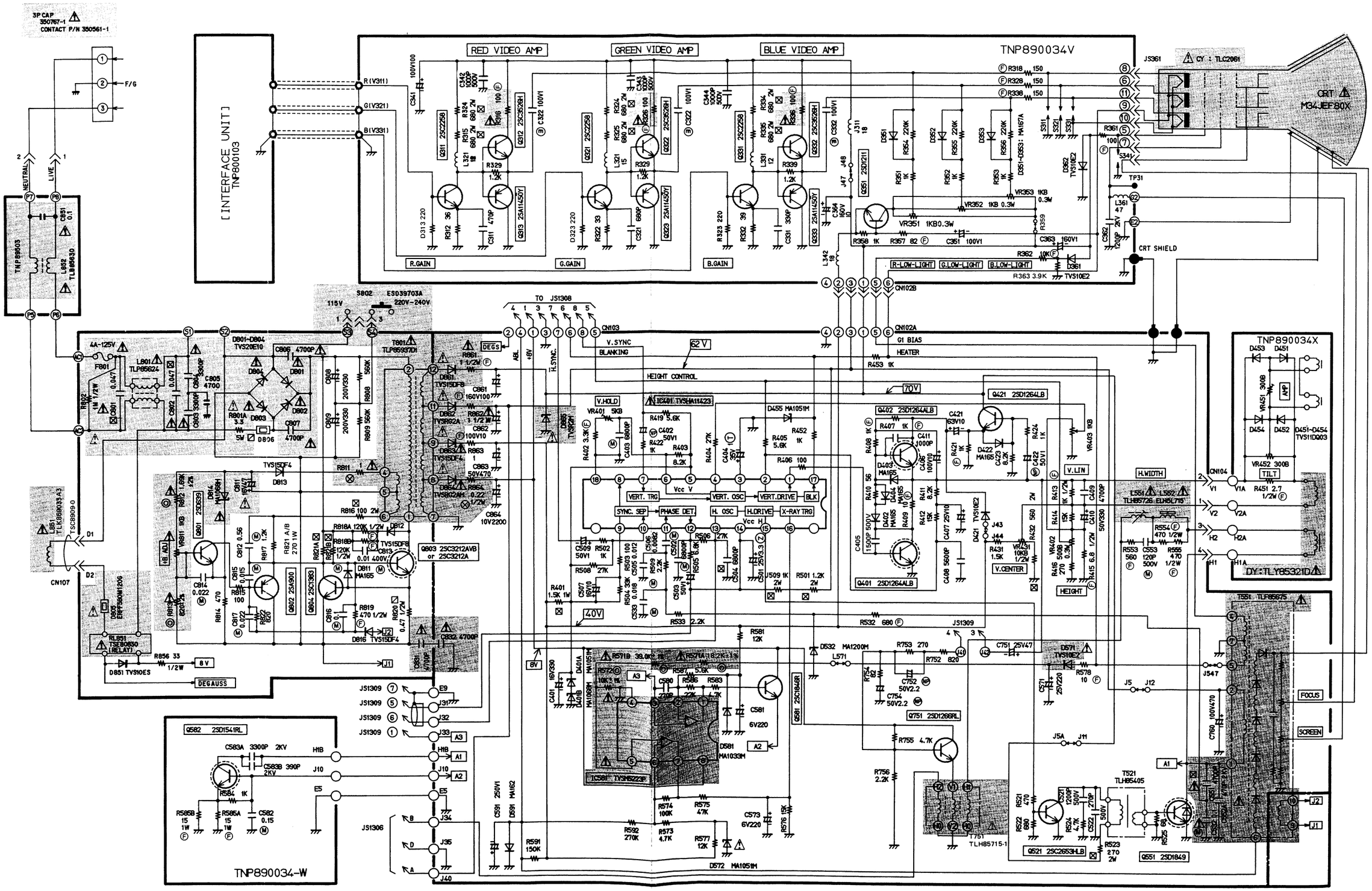


brown·brown·green .....
MA1051M, RD120EB
gray·gray·blue .....
MA1068H



red·brown .....
MA1120M
red·red .....
MA1220M

VIDE-V28805 / DRUCK: 5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L852
TLB85630
CB51
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G(V321)
B(V331)
RED VIDEO AMP
GREEN VIDEO AMP
BLUE VIDEO AMP
TNP890034V
R.GAIN
G.GAIN
B.GAIN
JS361
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M34JEF80X
TP31
CRT SHIELD
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G-LOW-LIGHT
B-LOW-LIGHT
CN102B
CN102A
G1 BIAS
HEATER
TNP890034X
S802
ES039703A
115V
220V-240V
TO JS1308
CN103
V.SYNC
BLANKING
HEIGHT CONTROL
62 V
70V
40V
8V
V.HOLD
IC401 TVSHA11423
Vcc V
VERT. TRG
VERT. OSC
VERT.DRIVE
BLK
SYNC. SEP
PHASE DET.
H. OSC
H.DRIVE
X-RAY TRG
Vcc H
V.LIN
V.CENTER
H.WIDTH
HEIGHT
TILT
CN104
V1
V1A
V2
V2A
H2
H2A
H1
H1A
DY:TLY85321D
FOCUS
SCREEN
DEGAUSS
RL851
TSE80830
(RELAY)
CN107
D1
D2
F801
4A-125V
T801
TLP85937D1
Q803 2SC3212AVB
or 2SC3212A
Q582 2SD1541RL
TNP890034-W
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JS1306
Q421 2SD1264LB
Q402 2SD1264LB
Q401 2SD1264ALB
Q751 2SD1266RL
Q521 2SC2653HLB
Q551 2SD1849
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D423 8.2K
D421 TVS10E2
D862 TVS10E2
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D811 MA165
D813 TVS15DF4
D816 TVS15DF4
D831 TVS15DF8
D832 TVS15DF4
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D864 TVS1824M1
D865 TVS24M
D803 ERF80W1206
D851 TVS10ES
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R816 100 2W
R818A 120K 1/2W
R818B 120K 1/2W
R861 1 1/2W
R862 1 1/2W
R863 1
R864 0.22 1/2W
R811 1
R419 5.6K
R422 1K
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R402 3.3K
R404 27K
R405 5.6K
R452 1K
R406 100
R407 1K
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R410 56
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R421 1K
R424 1K
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R452 300B
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R581 12K
R582 680
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R506 27K
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R502 1K
R503 100
R504 33K
R505 0.68K
R507 10
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R521 470
R522 680
R523 270 2W
R524 4.7K
R525 68
R526 270 2W
R527 18K 1%
R528 10K 1%
R529 39.0K 1%
R530 5.6K
R531 1.2K
R532 680
R533 2.2K
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R332 39
R323 220
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R359
R358 1K
R357 82
R362 10K
R363 3.9K
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VR351 1KB0.3W
VR352 1KB 0.3W
VR353 1KB 0.3W
VR401 5KB
VR402 500B 0.3W
VR431 10KB 1/2W
VR451 300B
VR452 300B
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C302 100V1
C351 100V1
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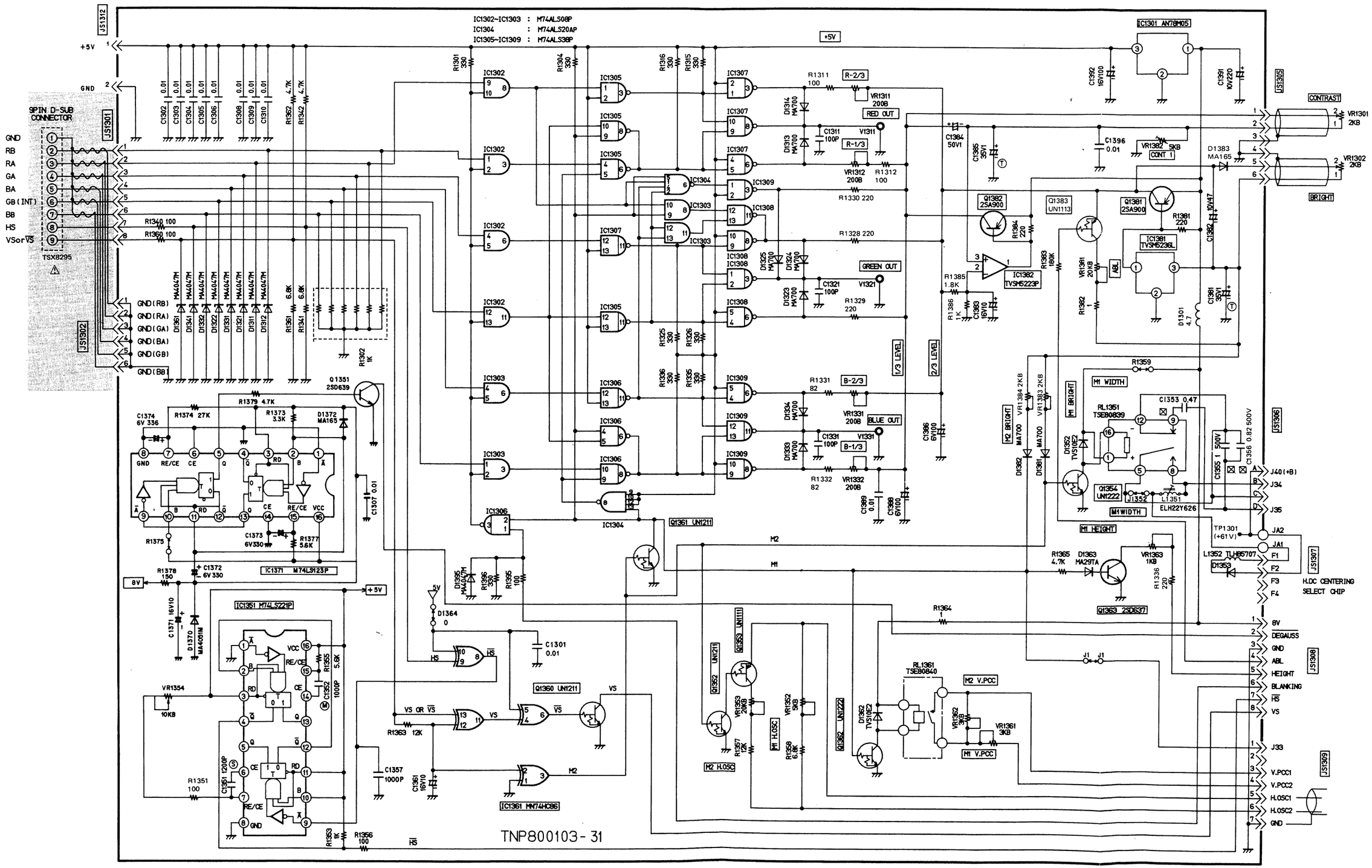
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IC1304 : M74ALS20AP
IC1305~IC1309 : M74ALS38P
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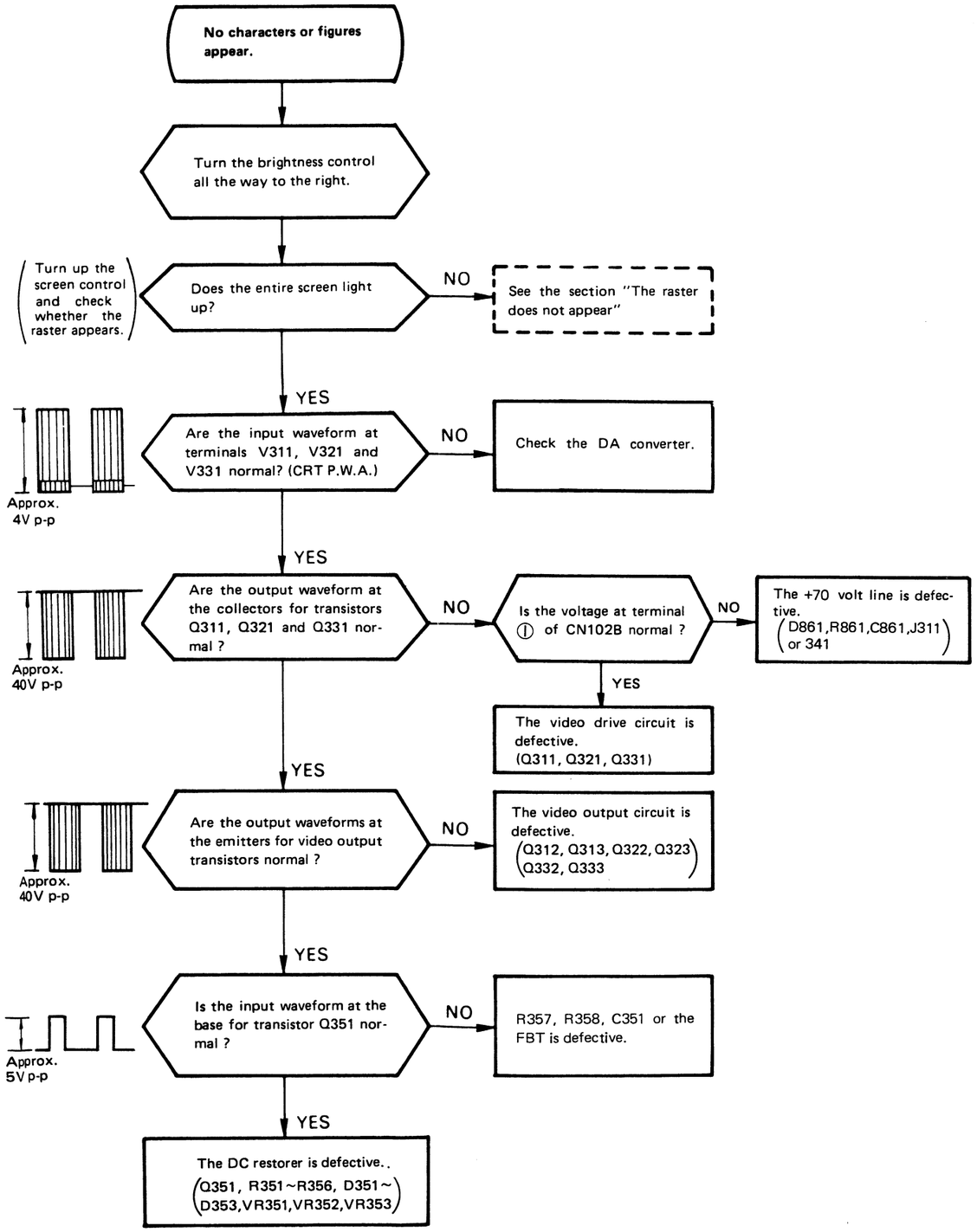
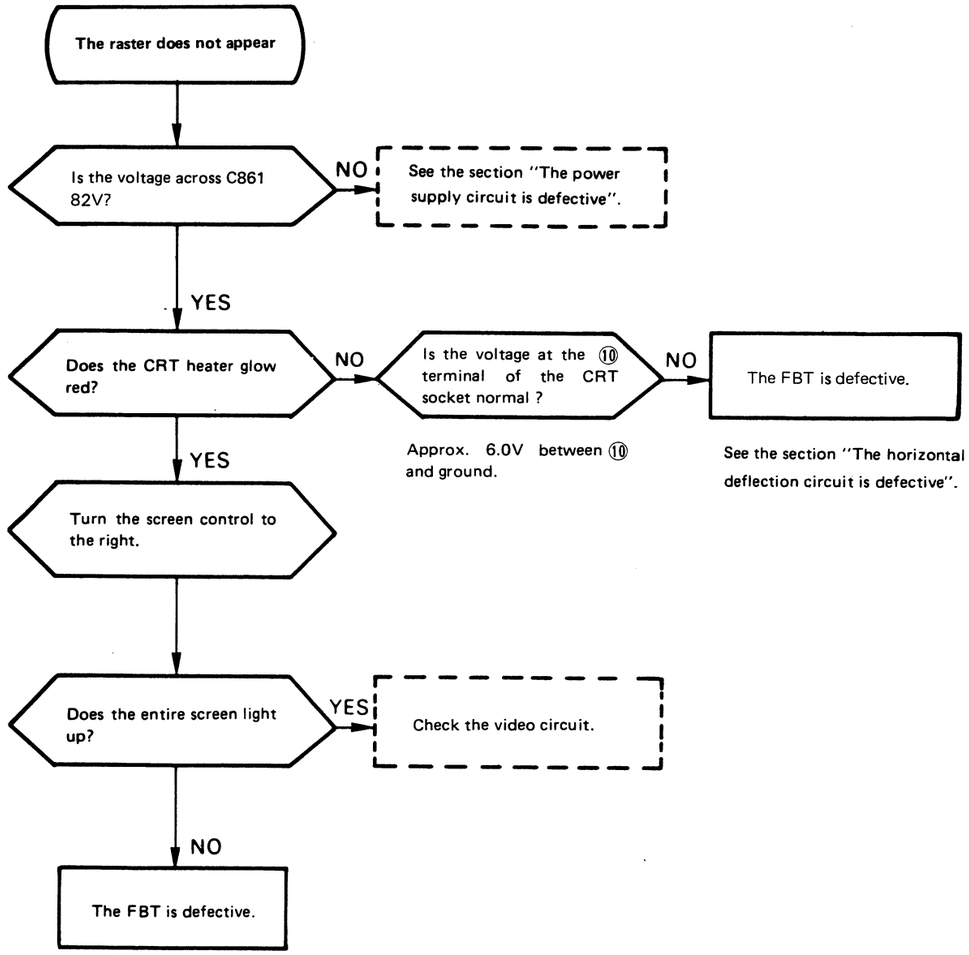
RB
RA
GA
BA
GB(INT)
BB
HS
VSorVS
GND(RB)
GND(RA)
GND(GA)
GND(BA)
GND(GB)
GND(BB)
+5V
8V
IC1371 M74LS123P
IC1351 M74LS221P
IC1361 MN74HC86
IC1301 AN78M05
Q1351 2SD639
Q1352 UN1211
Q1353 UN1111
Q1354 UN1222
Q1360 UN1211
Q1361 UN1211
Q1362 2SA900
Q1363 2SD637
Q1381 2SA900
Q1383 UN1113
IC1362 TVSH5223P
IC1381 TVSH5236L
RL1351 TSE80839
RL1361 TSE80840
L1351 ELH22Y626
L1352 TLH85707
R-2/3
R-1/3
B-2/3
B-1/3
RED OUT
GREEN OUT
BLUE OUT
1/3 LEVEL
2/3 LEVEL
M1 WIDTH
M1 BRIGHT
M2 BRIGHT
M1 HEIGHT
M1 H.OSC
M2 H.OSC
M1 V.PCC
M2 V.PCC
CONTRAST
BRIGHT
CONT 1
ABL
H.DC CENTERING SELECT CHIP
J40(+B)
J34
J35
J33
V.PCC1
V.PCC2
H.OSC1
H.OSC2
DEGAUSS
BLANKING
TNP800103-31

TROUBLE SHOOTING HINTS


No characters or figures appear.
Turn the brightness control all the way to the right.
Turn up the screen control and check whether the raster appears.
Does the entire screen light up?
NO
See the section "The raster does not appear"
YES
Approx. 4V p-p
Are the input waveform at terminals V311, V321 and V331 normal? (CRT P.W.A.)
NO
Check the DA converter.
YES
Approx. 40V p-p
Are the output waveform at the collectors for transistors Q311, Q321 and Q331 normal ?
NO
Is the voltage at terminal ① of CN102B normal ?
NO
The +70 volt line is defective. (D861,R861,C861,J311 or 341)
YES
The video drive circuit is defective. (Q311, Q321, Q331)
YES
Approx. 40V p-p
Are the output waveforms at the emitters for video output transistors normal ?
NO
The video output circuit is defective. (Q312, Q313, Q322, Q323 Q332, Q333)
YES
Approx. 5V p-p
Is the input waveform at the base for transistor Q351 normal ?
NO
R357, R358, C351 or the FBT is defective.
YES
The DC restorer is defective.. (Q351, R351~R356, D351~ D353,VR351,VR352,VR353)


The raster does not appear
Is the voltage across C861 82V?
NO
See the section "The power supply circuit is defective".
YES
Does the CRT heater glow red?
NO
Is the voltage at the ⑩ terminal of the CRT socket normal ?
NO
The FBT is defective.
Approx. 6.0V between ⑩ and ground.
See the section "The horizontal deflection circuit is defective".
YES
Turn the screen control to the right.
Does the entire screen light up?
YES
Check the video circuit.
NO
The FBT is defective.

VIDE-V28805/ DRUCK: 8

The horizontal deflection circuit is defective.

Is the voltage across C861 82V?

NO

Is the fuse normal?

NO

Replace the fuse.

Is the fuse normal?

NO

The power supply circuit is defective or Q402 is shorted out.

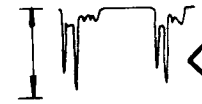
YES

Is the power supply circuit normal?

NO

See the section on Power Supply problems.

YES



Approx. 18V p-p

Is the waveform at the base of Q551 normal?

YES

The FBT is defective.

NO

Approx. 0.8V p-p

Is the waveform at the base of Q521 normal?

YES

Q521 or T521 is defective.

NO

Approx. 4.0V p-p

Is the waveform normal at pin 15 of IC401 ?

YES

R521 or R522 is defective.

NO

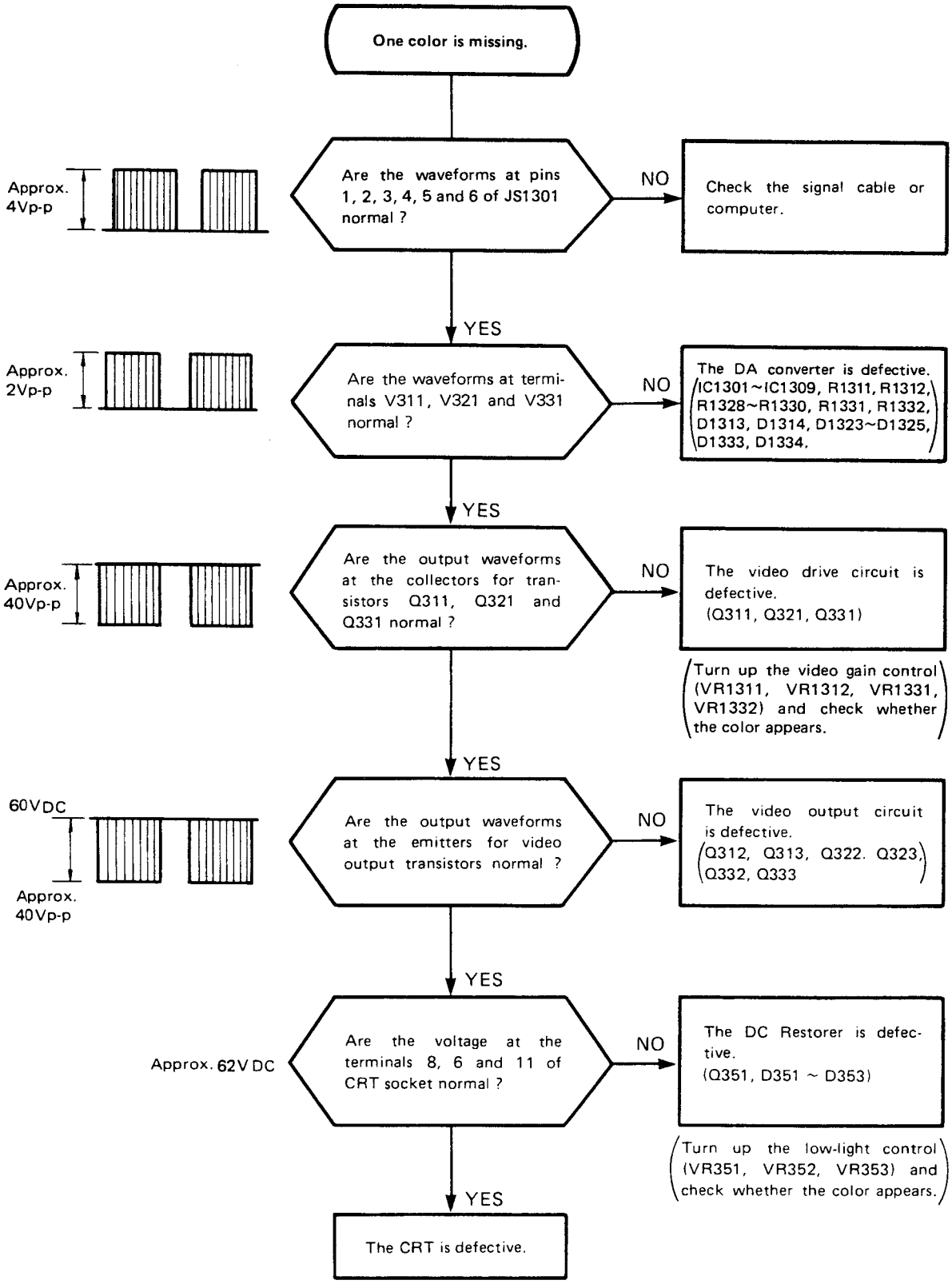
Is the voltage at pin 14 of IC401 about 12.8V?

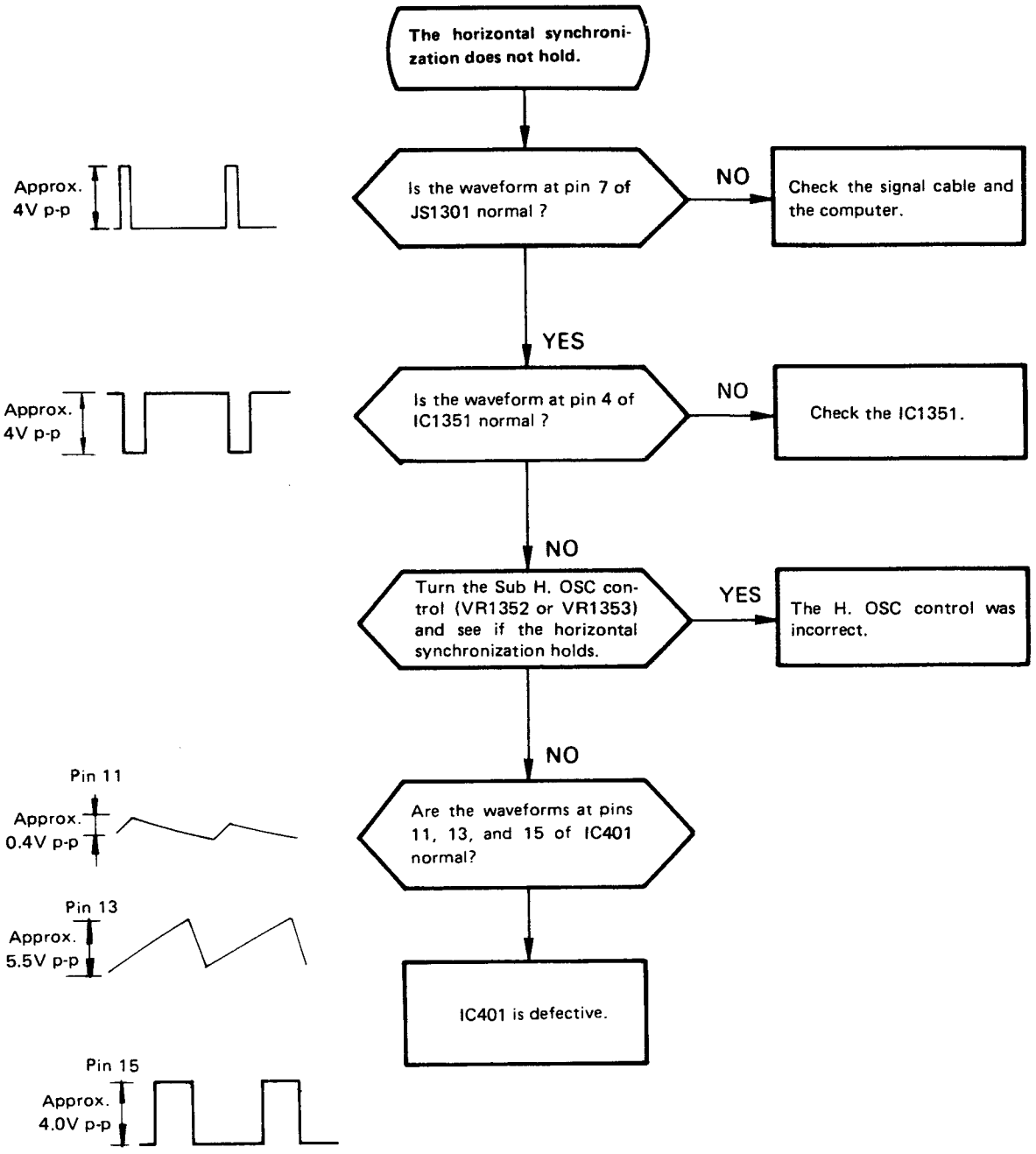
NO

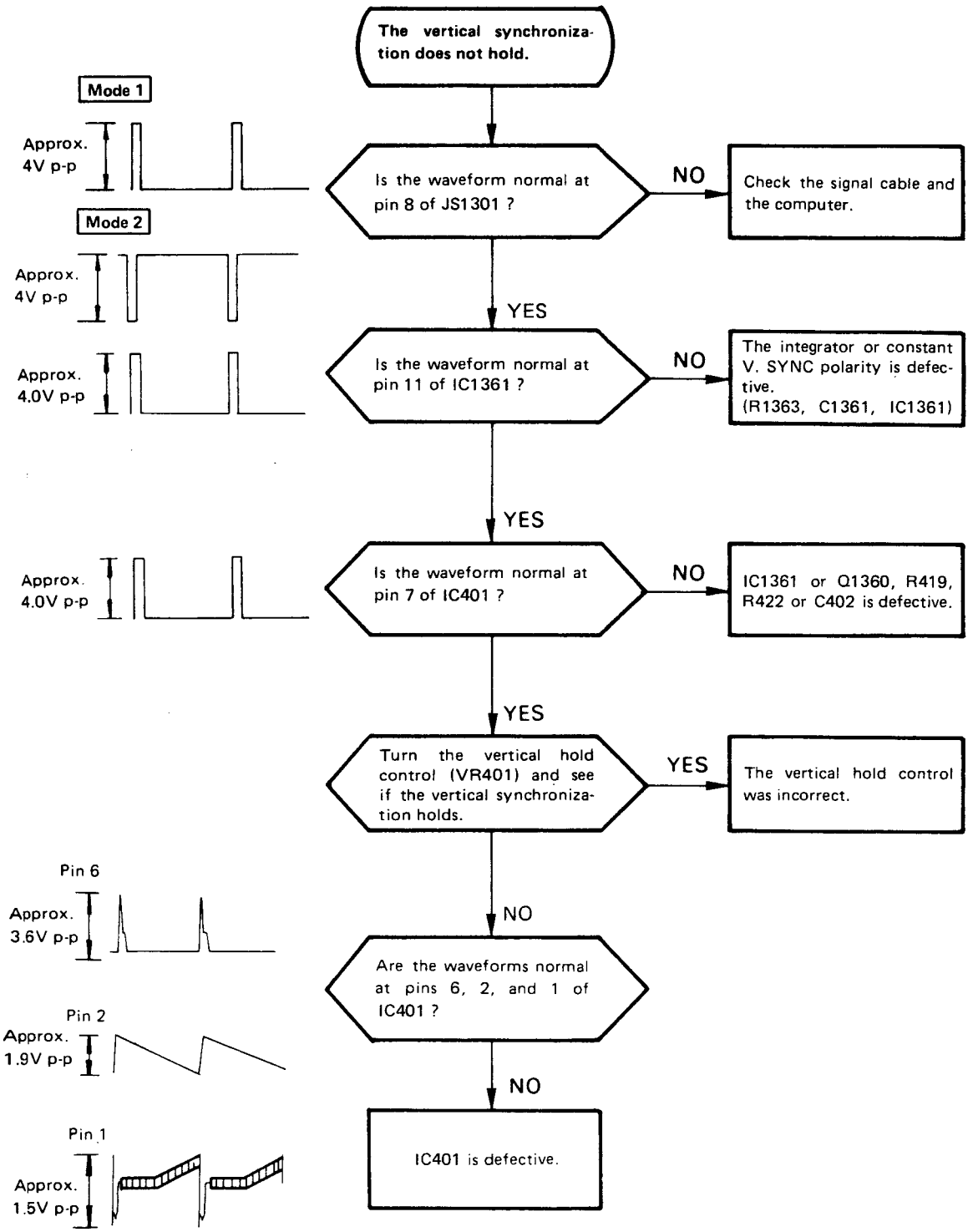
Check the +62V line.
Check R501, J509, C501.

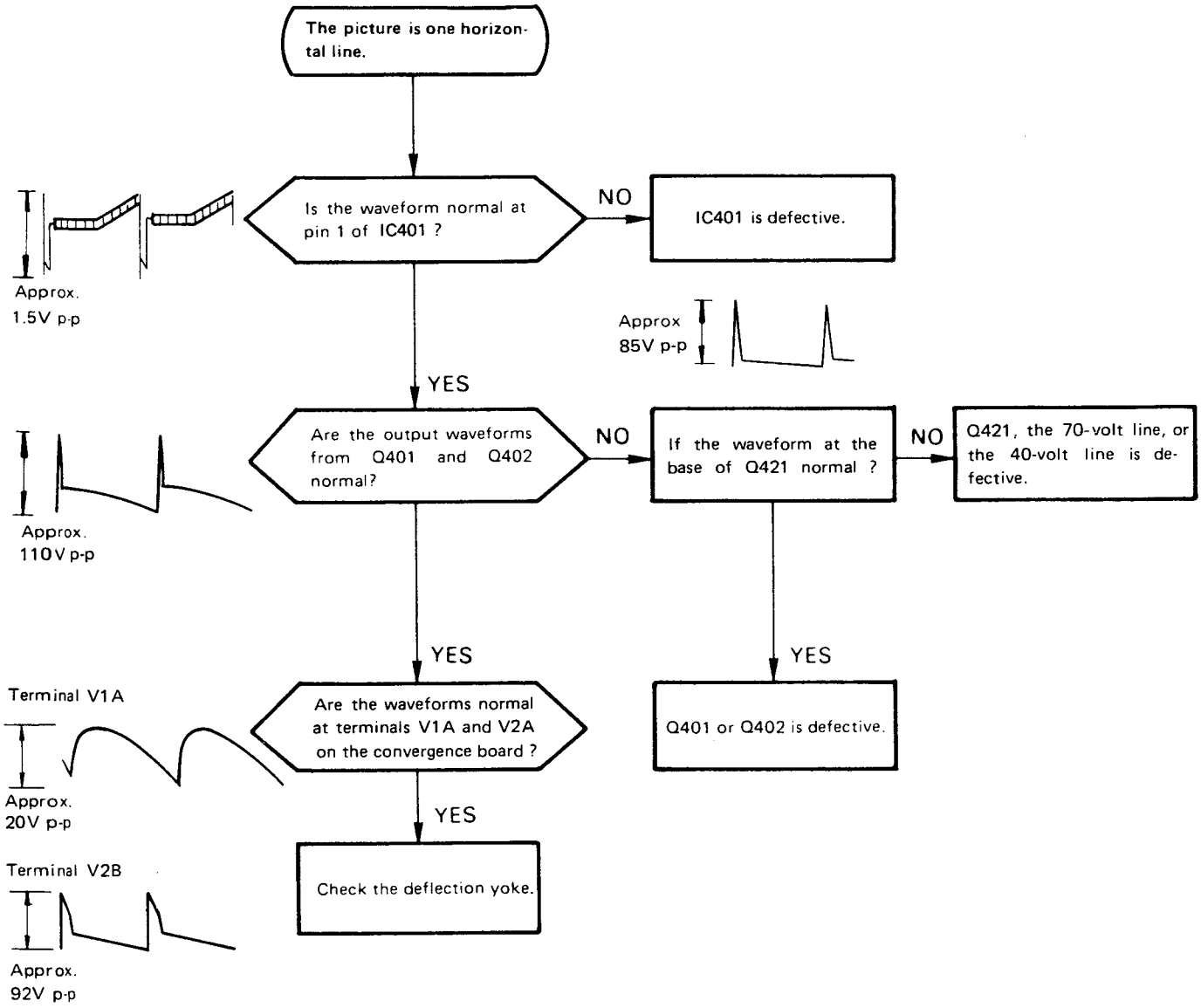
YES

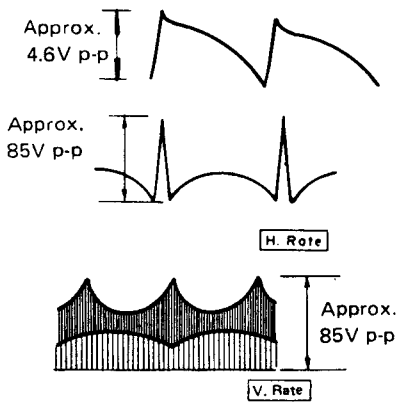
IC401 is defective.


One color is missing.
Approx. 4Vp-p
Are the waveforms at pins 1, 2, 3, 4, 5 and 6 of JS1301 normal ?
NO
Check the signal cable or computer.
YES
Approx. 2Vp-p
Are the waveforms at terminals V311, V321 and V331 normal ?
NO
The DA converter is defective. (IC1301~IC1309, R1311, R1312, R1328~R1330, R1331, R1332, D1313, D1314, D1323~D1325, D1333, D1334.
YES
Approx. 40Vp-p
Are the output waveforms at the collectors for transistors Q311, Q321 and Q331 normal ?
NO
The video drive circuit is defective. (Q311, Q321, Q331)
(Turn up the video gain control (VR1311, VR1312, VR1331, VR1332) and check whether the color appears.)
YES
60VDC
Approx. 40Vp-p
Are the output waveforms at the emitters for video output transistors normal ?
NO
The video output circuit is defective. (Q312, Q313, Q322. Q323, Q332, Q333
YES
Approx. 62V DC
Are the voltage at the terminals 8, 6 and 11 of CRT socket normal ?
NO
The DC Restorer is defective. (Q351, D351 ~ D353)
(Turn up the low-light control (VR351, VR352, VR353) and check whether the color appears.)
YES
The CRT is defective.


The horizontal synchronization does not hold.
Is the waveform at pin 7 of JS1301 normal ?
NO
Check the signal cable and the computer.
YES
Approx. 4V p-p
Is the waveform at pin 4 of IC1351 normal ?
NO
Check the IC1351.
Approx. 4V p-p
NO
Turn the Sub H. OSC control (VR1352 or VR1353) and see if the horizontal synchronization holds.
YES
The H. OSC control was incorrect.
NO
Pin 11
Approx. 0.4V p-p
Are the waveforms at pins 11, 13, and 15 of IC401 normal?
Pin 13
Approx. 5.5V p-p
IC401 is defective.
Pin 15
Approx. 4.0V p-p


The vertical synchronization does not hold.
Mode 1
Approx. 4V p-p
Mode 2
Approx. 4V p-p
Is the waveform normal at pin 8 of JS1301 ?
NO
Check the signal cable and the computer.
YES
Approx. 4.0V p-p
Is the waveform normal at pin 11 of IC1361 ?
NO
The integrator or constant V. SYNC polarity is defective. (R1363, C1361, IC1361)
YES
Approx. 4.0V p-p
Is the waveform normal at pin 7 of IC401 ?
NO
IC1361 or Q1360, R419, R422 or C402 is defective.
YES
Turn the vertical hold control (VR401) and see if the vertical synchronization holds.
YES
The vertical hold control was incorrect.
NO
Pin 6
Approx. 3.6V p-p
Pin 2
Approx. 1.9V p-p
Pin 1
Approx. 1.5V p-p
Are the waveforms normal at pins 6, 2, and 1 of IC401 ?
NO
IC401 is defective.


The picture is one horizontal line.
Is the waveform normal at pin 1 of IC401 ?
NO
IC401 is defective.
Approx. 1.5V p-p
Approx 85V p-p
YES
Are the output waveforms from Q401 and Q402 normal?
NO
If the waveform at the base of Q421 normal ?
NO
Q421, the 70-volt line, or the 40-volt line is defective.
Approx. 110V p-p
YES
YES
Terminal V1A
Are the waveforms normal at terminals V1A and V2A on the convergence board ?
Q401 or Q402 is defective.
Approx. 20V p-p
YES
Terminal V2B
Check the deflection yoke.
Approx. 92V p-p



The much side pincushion distortion .

Is the waveform at the base of Q751 normal?

YES → Check C751, VR1361, VR-1362, R752, R753, C752, R754, C754, Q1362 and RL1361.

NO

Is the waveform at the terminal H1 of T751 normal ?

YES → The horizontal deflection circuit is defective.

NO

Q751, T751, C1353, C1355, C1356, RL1351 or Q1354 is defective.

The power supply circuit is defective.

Is the voltage at the terminal 2 of T801 about 260V ?

NO → The noise filter or the rectifier circuit is defective.

YES

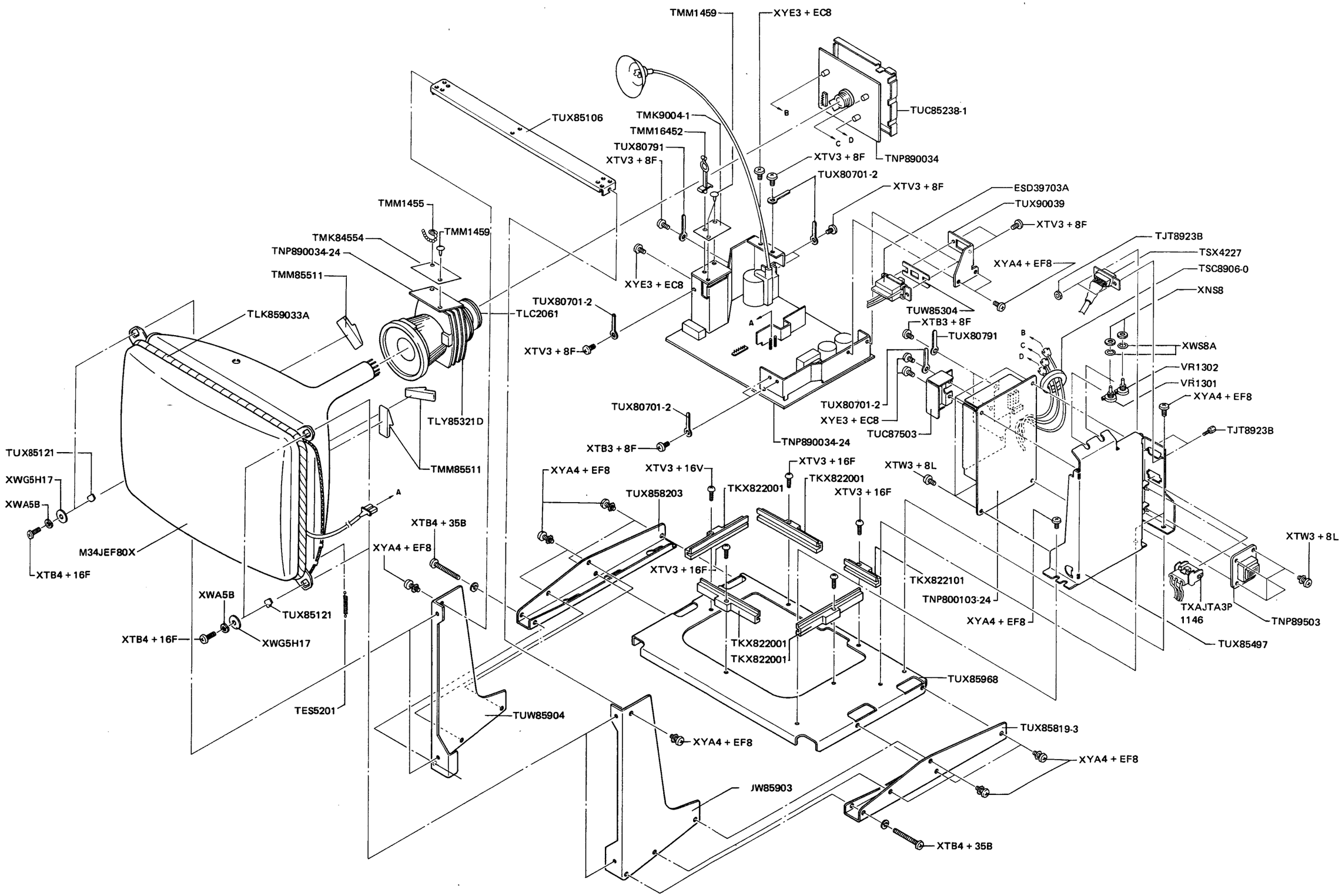
Is the waveform at the collector of Q803 normal?

NO → Check Q803, R821A, R821B, R816, C812 and R817.

YES

Check T801, C861, D861, R861, D862, C862, R862, D863, R863, C863, D864, R864, C864 and D865.

EXPLODED VIEW



REPLACEMENT PARTS LIST

Important Safety Notice

Components identified by the International symbol ⚠ have special characteristics important for safety.
When replacing any of these components use only manufacture's specified parts.

RESISTOR

PART NAME & DESCRIPTION			
TYPE		ALLOWANCE	
C	Carbon	F	± 1%
F	Fuse	J	± 5%
M	Metal Oxide	K	± 10%
S	Solid	M	± 20%
W	Wire Wound	G	± 2%

Part No. Description
Example: ERD25TJ104 ⓒ 100K Ⓙ 1/4W

CAPACITOR

PART NAME & DESCRIPTION			
TYPE		ALLOWANCE	
C	Ceramic	C	± 0.25pF
E	Electrolytic	D	± 0.5pF
P	Polyester	F	± 1pF
S	Styrol	J	± 5%
T	Tantalum	K	± 10%
PP	Polypropylene	L	± 15%
		M	± 20%
		P	+100% –0%
		Z	+80% –20%

Part No. Description
Example: ECKF1H103ZF ⓒ 0.01μF Ⓩ 50V

	Ref.No.	Part No.	Description
		CABINET & MAIN PARTS	
		TKX822001	PC BOARD HOLDER(BIG)
		TKX822101	PC BOARD HOLDER(SMALL)
		TUW85903	SIDE PLATE(R)
		TUW85904	SIDE PLATE(L)
		TUX80701-2	CORD BRACKET (BIG)
		TUX80971	CORD BRACKET
		TUX85106	UPPER PLATE
		TUX85121	BRACKET (CRT)
		TUX85497	IF PC BOARD BRACKET
		TUX85819-3	SIDE BRACKET (R)
		TUX85820-3	SIDE BRACKET (L)
		TUX85968	BOTTOM PLATE
		TUC85238-1	SHIELD PLATE (CRT BOARD)
		TUC87503	SHIELD CASE (CONNECTOR)
		TUX87706	SIGNAL CORD BRACKET
⚠		TBM850114-1	MODEL PLATE
		TES5201	SPRING(COIL)
		TMM1455	BEADS BAND
		TMM1459	CLIP
		TMM16452	CLAMPER(ANODE)BIG
		TMM81416	CORD BAND (SMALL)
		TMM85411	BARRIER (EDGE)
⚠		TMM85511	RUBBER (WEDGE)
		TMK84549	PARMALLOY (BIG)
		TMK84554	BARRIER (DY)
		TMK84557	PARMALLOY (SMALL)
		XNS8	NUT
		XTB4+16F	SCREW
		XTB4+35B	SCREW
		XTV3+16F	SCREW
		XTV3+8F	SCREW
		XTW3+8L	SCREW
		XWA4B	WASHER
		XWA5B	WASHER
		XWG5H17	WASHER
		XWS8A	WASHER
		XYA4+EF8	SCREW
		XYE3+EC8	SCREW
		XYE3+EF8	SCREW
⚠		M34JEF80X	PICTURE TUBE
⚠		TNP800103-24	PC BOARD W/COMPONENT(IF)
⚠		TNP890034-24	PC BOARD W/COMPONENT(M)
⚠		TNP89503-23	PC BOARD W/COMPONENT(LF)
⚠		TLY85321D	DEFLECTION YOKE
⚠		TLC2061	CONVERGENCE COIL
⚠		TLK859023A	DEGAUSS COIL
		TSX4227	SIGNAL CORD
		TJT8923B	CONNECTOR FIX POST
		TXAJTE6P397	6P CONNECTOR ASSY
		TSC8906-0	FERRITE CORE (BIG)
		TSN85511	MAGNET
	VR1301	EVH60AF20B23	CONTROL 2K OHM (CONTRAST)
	VR1302	EVH60AF20B23	CONTROL 2K OHM (BRIGHT)
		T4F72425Q	COTTON TAPE 55M
		T4F80918-1	TAPE
		T4F90219-1	MAIRA TAPE 20M
		TPC8538601	OUTER CARTON
		TPD359036	FILLER
		TXAPD21404XE	FILLER
		TPE814055	SET COVER
⚠		TQF80759	WARNING LABEL
⚠		TQF81735	GND MARK LABEL
⚠		TQF83648	FUSE LABEL
		TQF83825-3	SERIAL LABEL
		TQF85210	HIGH VOLTAGE LABEL
		I.C	
⚠	IC401	TVSHA11423	INTEGRATED CIRCUIT
⚠	IC581	TVSM5223P	INTEGRATED CIRCUIT
	IC1301	AN78M05	INTEGRATED CIRCUIT
	IC1302	M74ALS08P	INTEGRATED CIRCUIT
	IC1303	M74ALS08P	INTEGRATED CIRCUIT
	IC1304	M74ALS20AP	INTEGRATED CIRCUIT
	IC1305	M74ALS38P	INTEGRATED CIRCUIT
	IC1306	M74ALS38P	INTEGRATED CIRCUIT
	IC1307	M74ALS38P	INTEGRATED CIRCUIT
	IC1308	M74ALS38P	INTEGRATED CIRCUIT
	IC1309	M74ALS38P	INTEGRATED CIRCUIT
	IC1351	M74LS221P	INTEGRATED CIRCUIT
	IC1361	MN74HC86	INTEGRATED CIRCUIT
	IC1371	M74LS123P	INTEGRATED CIRCUIT
	IC1381	TVSM5236L	INTEGRATED CIRCUIT
	IC1382	TVSM5223P	INTEGRATED CIRCUIT
		TRANSISTORS	
	Q311	2SC2258	TRANSISTOR
	Q312	2SC3526H	TRANSISTOR
	Q313	2SA1145OY	TRANSISTOR
	Q321	2SC2258	TRANSISTOR
	Q322	2SC3526H	TRANSISTOR
	Q323	2SA1145OY	TRANSISTOR
	Q331	2SC2258	TRANSISTOR
	Q332	2SC3526H	TRANSISTOR
	Q333	2SA1145OY	TRANSISTOR
	Q351	2SD1211R	TRANSISTOR
	Q421	2SD1264PLB	TRANSISTOR
	Q521	2SC2653HLB	TRANSISTOR
	Q551	2SD1849F	TRANSISTOR
	Q581	2SC1846R	TRANSISTOR
	Q582	2SD1541RL	TRANSISTOR
	Q751	2SD1266R	TRANSISTOR
	Q801	2SD639R	TRANSISTOR
	Q802	2SA900R	TRANSISTOR
	Q803	2SC3212A	TRANSISTOR
	Q804	2SC1383R	TRANSISTOR
	Q1351	2SD639R	TRANSISTOR
	Q1352	UN1211	TRANSISTOR
	Q1353	UN1111	TRANSISTOR
	Q1354	UN1222	TRANSISTOR
	Q1360	UN1211	TRANSISTOR
	Q1361	UN1211	TRANSISTOR
	Q1362	UN1222	TRANSISTOR
	Q1363	2SD637R	TRANSISTOR
	Q1381	2SA900R	TRANSISTOR
	Q1382	2SA900R	TRANSISTOR
	Q1383	UN1113	TRANSISTOR
		DIODES	
	D1	TEL302-9	TERMINAL
	D2	TEL302-9	TERMINAL
	D313	ERDS2TJ221	C 220 OHM J 1/4W
	D323	ERDS2TJ221	C 220 OHM J 1/4W
	D333	ERDS2TJ221	C 220 OHM J 1/4W
	D351	MA167A	DIODE.SI
	D352	MA167A	DIODE.SI
	D353	MA167A	DIODE.SI
	D361	TVS10E2	DIODE
	D362	TVS10E2	DIODE
	D401A	MA1051M	DIODE
	D401B	MA1068M	DIODE
	D402	MA165	DIODE
	D403	MA165	DIODE
	D404	MA165	DIODE
	D421	TVS10E2	DIODE
	D422	MA165	DIODE
	D451	TVS11DQ03C	DIODE
	D452	TVS11DQ03C	DIODE
	D453	TVS11DQ03C	DIODE
	D454	TVS11DQ03C	DIODE
	D455	MA1051M	DIODE
	D532	MA1200M	DIODE
⚠	D571	TVS10E2	DIODE
⚠	D572	MA1051M	DIODE
	D581	MA1033M	DIODE
	D591	MA162	DIODE
⚠	D801	TVS20E10	DIODE
⚠	D802	TVS20E10	DIODE
⚠	D803	TVS20E10	DIODE
⚠	D804	TVS20E10	DIODE
⚠	D805	ERPF5B0M120G	POSISTOR
	D806	ERTD6FFK160M	THERMISTOR
	D811	MA165	DIODE
	D812	TVS15DF8	DIODE
	D813	TVS15DF4	DIODE
⚠	D814	MA1068H	DIODE
	D816	TVS15DF4	DIODE
	D851	TVS10E2	DIODE
⚠	D861	TVS15DF8	DIODE
⚠	D862	TVSRG2ALFB1	DIODE
⚠	D863	TVS15DF4	DIODE
⚠	D864	TVSRG2ALFB1	DIODE
⚠	D865	TVSR2M	DIODE
	D1301	TLQ047K126Y	PEAKING COIL
	D1311	MA4047M	DIODE.SI
	D1312	MA4047M	DIODE.SI
	D1313	MA700	DIODE.SI
	D1314	MA700	DIODE.SI
	D1321	MA4047M	DIODE.SI
	D1322	MA4047M	DIODE.SI
	D1323	MA700	DIODE.SI
	D1324	MA700	DIODE.SI
	D1325	MA700	DIODE.SI
	D1331	MA4047M	DIODE.SI
	D1332	MA4047M	DIODE.SI
	D1333	MA700	DIODE.SI
	D1334	MA700	DIODE.SI
	D1341	MA4047M	DIODE.SI
	D1352	TVS10E2	DIODE
	D1353	TVS15DF4	DIODE
	D1361	MA4047M	DIODE.SI
	D1362	TVS10E2	DIODE
	D1363	MA29TA	DIODE
	D1364	ERDS2TC0	C 0 OHM 1/4W
	D1370	MA4051M	DIODE
	D1372	MA165	DIODE
	D1381	MA700	DIODE.SI
	D1382	MA700	DIODE.SI
	D1383	MA165	DIODE
	D1395	MA4047M	DIODE.SI
		COIL & TRANSFORMERS	
	L311	TLU120J186	PEAKING COIL
	L321	TLU150K186	PEAKING COIL
	L331	TLU120J186	PEAKING COIL

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	Ref.No.	Part No.	Description
	L341	ERDS1FJ562	C 5.6K OHM J 1/2W
	L342	TLU180J186	PEAKING COIL
	L361	TLU470K186	PEAKING COIL
⚠	L551	TLH85726	COIL
⚠	L552	ELH5L715	COIL
⚠	L801	TLP85624	TRANS
⚠	L852	TLP85630	TRANS(LINE FILTER)
	L1351	ELH22Y626	COIL
	L1352	TLH85807	COIL
	T521	ETH19Y65AY	COIL
⚠	T551	TLF85675	FLYBACK TRANS
⚠	T751	TLH85715-1	COIL
⚠	T801	TLP85937D1	TRANS
		CONTROL	
	VR351	EVN4HCA00B13	CONTROL B 1K OHM
	VR352	EVN4HCA00B13	CONTROL B 1K OHM
	VR353	EVN4HCA00B13	CONTROL B 1K OHM
	VR401	EVN4HCA00B53	CONTROL B 5K OHM
	VR402	EVM31GA00B52	CONTROL B 500 OHM
	VR403	EVN4HCA00B13	CONTROL B 1K OHM
	VR431	EVMK0GA00B14	CONTROL B 10K OHM
	VR451	EVNK4BA00B32	CONTROL B 300 OHM
	VR452	EVNK4BA00B32	CONTROL B 300 OHM
⚠	VR811	EVN4HCA00B13	CONTROL B 1K OHM
	VR1311	EVN4HCA00B22	CONTROL B 200 OHM
	VR1312	EVN4HCA00B22	CONTROL B 200 OHM
	VR1331	EVN4HCA00B22	CONTROL B 200 OHM
	VR1332	EVN4HCA00B22	CONTROL B 200 OHM
	VR1351	EVN32CA00B14	CONTROL B 10K OHM
	VR1352	EVN32CA00B53	CONTROL B 5K OHM
	VR1353	EVN32CA00B24	CONTROL B 20K OHM
	VR1361	EVN32CA00B33	CONTROL B 3K OHM
	VR1362	EVN32CA00B33	CONTROL B 3K OHM
	VR1363	EVM31GA00B13	CONTROL B 1K OHM
	VR1381	EVN4HCA00B24	CONTROL B 20K OHM
	VR1382	EVN4HCA00B53	CONTROL B 5K OHM
	VR1383	EVN32CA00B23	CONTROL B 2K OHM
	VR1384	EVN32CA00B23	CONTROL B 2K OHM
		CAPACITORS	
	C311	ECKF1H471KB	C 470PF K 50V
	C312	ECQE1105KZ	P 1.0UF K 100V
	C321	ECKF1H681KB	C 680PF K 50V
	C322	ECQE1105KZ	P 1.0UF K 100V
	C331	ECKF1H331KB	C 330PF K 50V
	C332	ECQE1105KZ	P 1.0UF K 100V
	C341	ECEA2AG101S	E 100UF 100V
	C342	ECKD2H102KB2	C 1000PF K 500V
	C343	ECKD2H102KB2	C 1000PF K 500V
	C344	ECKD2H102KB2	C 1000PF K 500V
	C351	ECEA2AG010S	E 1UF 100V
	C362	ECKC3D122JBN	C 1200PF J 2KV
	C363	ECEA2CG010S	E 1UF 160V
	C364	ECEA2CS100	E 10UF 160V
	C401	ECEA1CGE331	E 330UF 16V
	C402A	ECEA1HGN010S	E 1UF 50V
	C403	ECQB1H682JZ	P 6800PF J 50V
	C404	ECSF1VE105JN	T 1.0UF 35V
	C405	ECKD2H152KB2	C 1500PF K 500V
	C406	ECEA2AGE100	E 10UF 100V
	C407	ECEA1EU100	E 10UF 25V

	Ref.No.	Part No.	Description
	C408	ECKF1H562KB	C 5600PF K 50V
	C409	ECKD2H472KB2	C 4700PF K 500V
	C410	ECEA1HGE331	E 330UF 50V
	C411	ECKD2H102KB2	C 1000PF K 500V
	C421	ECEA1JGE100	E 10UF 63V
	C422	ECEA1HGN010S	E 1UF 50V
	C423	ERDS2TJ822	C 8.2K OHM J 1/4W
	C501	ECEA25Z3R3	E 3.3UF 25V
	C502	ECQK1682JZ	P 6800PF J 100V
	C503	ECEA1HU010	E 1UF 50V
	C504	ECQP1682JZ	PP 6800PF J 100V
	C505	ECQB1H123JZ	P 0.012UF J 50V
	C506	ECQB1H822JZ	P 8200PF J 50V
	C507	ECEA1CGE100	E 10UF 16V
	C509	ECEA1HGE010	E 1UF 50V
	C521	ECKD2H122KB2	C 1200PF K 500V
	C522	ECKD2H271KB2	C 270PF K 500V
⚠	C532	ECQM1H104JZ	P 0.1UF J 50V
	C533	ECQM1H183JZ	P 0.018UF J 50V
⚠	C551	ECWH12H472JS	PP 4700PF J 1.2KV
⚠	C552A	ECKC3D471JBN	C 470PF J 2KV
	C553	ECCD2H121K	C 120PF K 500V
	C571	ECEA1EGE221	E 220UF 25V
	C573	ECEA0JU221	E 220UF 6.3V
	C580	ECCF1H271J	C 270PF J 50V
	C581	ECEA0JU221	E 220UF 6.3V
	C582	ECQM1H154JZ	P 0.15UF J 50V
	C583A	ECKC3D332JBN	C 3300PF J 2KV
	C583B	ECKC3D391JBN	C 390PF J 2KV
	C591	ECEA2EG010S	E 1UF 250V
	C751	ECEA1EGE470	E 47UF 25V
	C752	ECEA1HGN2R2	E 2.2UF 50V
	C754	ECEA1HGN2R2	E 2.2UF 50V
	C760	ECEA2AGE471	E 470UF 100V
⚠	C801	ECQU2A104MNF	PP 0.1UF M 250V
⚠	C802	ECQU2A104MNF	PP 0.1UF M 250V
⚠	C803	ECKCNS332MFJ	C 3300PF M
⚠	C804	ECKCNS332MFJ	C 3300PF M
⚠	C805	ECKCNS472MFJ	C 4700PF M
⚠	C806	ECKCNS472MFJ	C 4700PF M
⚠	C807	ECKCNS472MFJ	C 4700PF M
	C808	ECES2DU331G	E 330UF 200V
	C809	ECES2DU331G	E 330UF 200V
⚠	C811	ECEA1CFU470	E 47UF 16V
	C812	ECQV1H564JZ	P 0.56UF J 50V
	C813	ECQM4103KZ	P 0.01UF K 400V
	C814	ECQB1H223JZ	P 0.022UF J 50V
	C815	ECQB1H153JZ	P 0.015UF J 50V
	C816	ECQM1H104JZ	P 0.1UF J 50V
	C817	ECQM1H223JZ	P 0.022UF J 50V
⚠	C831	ECKCNS472MFJ	C 4700PF M
⚠	C832	ECKCNS472MFJ	C 4700PF M
⚠	C851	ECQU2A104MNF	PP 0.1UF M 250V
	C861	ECEA2CG101S	E 100UF 160V
	C862	ECEA2AG100S	E 10UF 100V
	C863	ECEA1HGE471	E 470UF 50V
	C864	ECEA1AGE222	E 2200UF 10V
	C1301	ECKF1H103ZF	C 0.01UF Z 50V
	C1302	ECKF1H103ZF	C 0.01UF Z 50V
	C1303	ECKF1H103ZF	C 0.01UF Z 50V
	C1304	ECKF1H103ZF	C 0.01UF Z 50V
	C1305	ECKF1H103ZF	C 0.01UF Z 50V

	Ref.No.	Part No.	Description
	C1306	ECKF1H103ZF	C 0.01UF Z 50V
	C1307	ECKF1H103ZF	C 0.01UF Z 50V
	C1308	ECKF1H103ZF	C 0.01UF Z 50V
	C1309	ECKF1H103ZF	C 0.01UF Z 50V
	C1310	ECKF1H103ZF	C 0.01UF Z 50V
	C1311	ECCF1H101J	C 100PF J 50V
	C1321	ECCF1H101J	C 100PF J 50V
	C1331	ECCF1H101J	C 100PF J 50V
	C1351	ECQS1122JZ	S 1200PF J 100V
	C1352	ECQK1102JZ	P 1000PF J 100V
	C1353	ECQF2H474JZ	PP 0.47UF J 500V
	C1355	ECWF2H105JZ	PP 1.0UF J 500V
	C1356	ECWF2H824JZ	PP 0.82UF J 500V
	C1357	ECKF1H102KB	C 1000PF K 50V
	C1361	ECEA1CU100	E 10UF 16V
	C1371	ECEA1CU100	E 10UF 16V
	C1372	ECEA0JU331	E 330UF 6.3V
	C1373	ECEA0JU331	E 330UF 6.3V
	C1381	ECSF1VE105Y	T 1.0UF 35V
	C1382	ECEA1AG470S	E 47UF 10V
	C1383	ECEA1CU100	E 10UF 16V
	C1384	ECEA1HG010S	E 1UF 50V
	C1385	ECSF1VE105Y	T 1.0UF 35V
	C1386	ECEA0JU101	E 100UF 6.3V
	C1388	ECEA0JU101	E 100UF 6.3V
	C1389	ECKF1H103ZF	C 0.01UF Z 50V
	C1391	ECEA1AGE221	E 220UF 10V
	C1392	ECEA1CU101	E 100UF 16V
	C1397	ECKF1H103ZF	C 0.01UF Z 50V
	C1398	ECKF1H103ZF	C 0.01UF Z 50V
		RESISTORS	
	J311	TLQ180J126	PEAKING COIL
	J508	ERQ14AJ1R0	F 1 OHM J 1/4W
	J509	ERG2SJ102	M 1K OHM J 2W
	J5-J12	TXAJTE1P151	1P CONNECTOR ASSY
	R312	ERDS2TJ360	C 36 OHM J 1/4W
	R314	ERG2ANJ681	M 680 OHM J 2W
	R315	ERG2ANJ681	M 680 OHM J 2W
⚠	R316	ERD25FJ101K	C 100 OHM J 1/4W
	R318	ERD25FJ151K	C 150 OHM J 1/4W
	R319	ERDS2TJ122	C 1.2K OHM J 1/4W
	R322	ERDS2TJ330	C 33 OHM J 1/4W
	R324	ERG2ANJ681	M 680 OHM J 2W
	R325	ERG2ANJ681	M 680 OHM J 2W
⚠	R326	ERD25FJ101K	C 100 OHM J 1/4W
	R328	ERD25FJ151K	C 150 OHM J 1/4W
	R329	ERDS2TJ122	C 1.2K OHM J 1/4W
	R332	ERDS2TJ390	C 39 OHM J 1/4W
	R334	ERG2ANJ681	M 680 OHM J 2W
	R335	ERG2ANJ681	M 680 OHM J 2W
⚠	R336	ERD25FJ101K	C 100 OHM J 1/4W
	R338	ERD25FJ151K	C 150 OHM J 1/4W
	R339	ERDS2TJ122	C 1.2K OHM J 1/4W
	R351	ERDS2TJ102	C 1K OHM J 1/4W
	R352	ERDS2TJ102	C 1K OHM J 1/4W
	R353	ERDS2TJ102	C 1K OHM J 1/4W
	R354	ERDS2TJ224	C 220K OHM J 1/4W
	R355	ERDS2TJ224	C 220K OHM J 1/4W
	R356	ERDS2TJ224	C 220K OHM J 1/4W
	R357	ERD25FJ820K	C 82 OHM J 1/4W
	R358	ERDS2TJ102	C 1K OHM J 1/4W

	Ref.No.	Part No.	Description
	R361	ERD25FJ101K	C 100 OHM J 1/4W
	R362	ERD25FJ103K	C 10K OHM J 1/4W
	R363	ERDS2TJ392	C 3.9K OHM J 1/4W
	R401	ERG1ANJ152	M 1.5K OHM J 1W
	R402	ERD25FJ332K	C 3.3K OHM J 1/4W
	R403	ERDS2TJ822	C 8.2K OHM J 1/4W
	R404	ERDS2TJ273	C 27K OHM J 1/4W
	R405	ERDS2TJ562	C 5.6K OHM J 1/4W
	R406	ERDS2TJ101	C 100 OHM J 1/4W
	R407	ERD25FJ102K	C 1K OHM J 1/4W
	R408	ERD25FJ102K	C 1K OHM J 1/4W
	R409	ERD25FJ100K	C 10 OHM J 1/4W
	R410	ERDS2TJ560	C 56 OHM J 1/4W
	R411	ERDS2TJ822	C 8.2K OHM J 1/4W
	R412	ERDS2TJ153	C 15K OHM J 1/4W
	R413	ERDS1FJ102	C 1K OHM J 1/2W
	R414	ERDS2TJ153	C 15K OHM J 1/4W
	R415	ERDS1FJ6R8	C 6.8 OHM J 1/2W
	R416	ERDS2TJ271	C 270 OHM J 1/4W
	R419	ERDS2TJ562	C 5.6K OHM J 1/4W
	R421	ERDS1FJ102	C 1K OHM J 1/2W
	R422	ERDS2TJ102	C 1K OHM J 1/4W
	R424	ERDS2TJ102	C 1K OHM J 1/4W
	R431	ERDS2TJ152	C 1.5K OHM J 1/4W
	R432	ERG2ANJ561	M 560 OHM J 2W
	R451	ERDS1FJ2R7	C 2.7 OHM J 1/2W
	R452	ERDS2TJ102	C 1K OHM J 1/4W
	R453	ERDS2TJ102	C 1K OHM J 1/4W
	R501	ERG2ANJ122	M 1.2K OHM J 2W
	R502	ERDS2TJ102	C 1K OHM J 1/4W
	R503	ERDS2TJ101	C 100 OHM J 1/4W
	R504	ERDS2TJ333	C 33K OHM J 1/4W
	R505	ERDS2TJ682	C 6.8K OHM J 1/4W
	R506	ERDS2TJ273	C 27K OHM J 1/4W
	R508	ERDS2TJ273	C 27K OHM J 1/4W
	R509	ERDS2TJ222	C 2.2K OHM J 1/4W
	R521	ERDS2TJ471	C 470 OHM J 1/4W
	R522	ERDS2TJ681	C 680 OHM J 1/4W
	R523	ERG2ANJ271	M 270 OHM J 2W
	R524	ERDS2TJ472	C 4.7K OHM J 1/4W
	R525	ERDS2TJ680	C 68 OHM J 1/4W
	R532	ERD25FJ681K	C 680 OHM J 1/4W
	R533	ERDS2TJ222	C 2.2K OHM J 1/4W
	R553	ERD25FJ561K	C 560 OHM J 1/4W
	R554	ERDS1FJ471	C 470 OHM J 1/2W
	R555	ERDS1FJ471	C 470 OHM J 1/2W
⚠	R571A	EROS2CKF1822	M 18.2K OHM F 1/4W
⚠	R571B	EROS2CKF3902	M 39K OHM F 1/4W
⚠	R572	EROS2CKF1002	M 10K OHM F 1/4W
	R573	ERDS2TJ472	C 4.7K OHM J 1/4W
	R574	ERDS2TJ104	C 100K OHM J 1/4W
	R575	ERDS2TJ473	C 47K OHM J 1/4W
	R576	ERDS2TJ153	C 15K OHM J 1/4W
	R577	ERDS2TJ123	C 12K OHM J 1/4W
	R578	ERD25FJ100K	C 10 OHM J 1/4W
	R581	ERDS2TJ123	C 12K OHM J 1/4W
	R583	ERDS2TJ472	C 4.7K OHM J 1/4W
	R584	ERD25FJ102K	C 1K OHM J 1/4W
	R585C	ERG1SJ150	M 15 OHM J 1W
	R585D	ERG1SJ150	M 15 OHM J 1W
	R586	ERDS2TJ223	C 22K OHM J 1/4W
	R587	ERDS2TJ562	C 5.6K OHM J 1/4W

	Ref.No.	Part No.	Description
	R591	ERDS2TJ154	C 150K OHM J 1/4W
	R592	ERDS2TJ274	C 270K OHM J 1/4W
	R752	ERDS2TJ821	C 820 OHM J 1/4W
	R753	ERDS2TJ271	C 270 OHM J 1/4W
	R754	ERDS2TJ820	C 82 OHM J 1/4W
	R755	ERDS2TJ472	C 4.7K OHM J 1/4W
	R756	ERDS2TJ222	C 2.2K OHM J 1/4W
⚠	R801A	ERF5ZYK3R3	W 3.3 OHM K 5W
⚠	R802	ERC12GJ105	S 1M OHM J 1/2W
	R808	ERD25FJ564K	C 560K OHM J 1/4W
	R809	ERD25FJ564K	C 560K OHM J 1/4W
⚠	R811	ERQ14AJ1R0	F 1 OHM J 1/4W
⚠	R812	EROS2CKG1691	M 1.69K OHM G 1/4W
⚠	R813	EROS2CKG8200	M 820 OHM G 1/4W
	R814	ERDS2TJ471	C 470 OHM J 1/4W
	R815	ERDS2TJ101	C 100 OHM J 1/4W
	R816	ERG2ANJ101	M 100 OHM J 2W
	R817	ERDS2TJ122	C 1.2K OHM J 1/4W
	R818A	ERDS1FJ124	C 120K OHM J 1/2W
	R818B	ERDS1FJ124	C 120K OHM J 1/2W
	R819	ERDS1FJ471	C 470 OHM J 1/2W
	R820	ERW12PKR47	W 0.47 OHM K 1/2W
	R821A	ERG1SJ274	M 270K OHM J 1W
	R821B	ERG1SJ274	M 270K OHM J 1W
	R822	ERDS2TJ821	C 820 OHM J 1/4W
	R856	ERDS1FJ330	C 33 OHM J 1/2W
⚠	R861	ERDS1FJ1R0	C 1 OHM J 1/2W
⚠	R862	ERDS1FJ1R0	C 1 OHM J 1/2W
	R863	ERD25FJ1R0K	C 1 OHM J 1/4W
⚠	R864	ERQ12HKR22	F 0.22 OHM K 1/2W
	R1301	ERDS2TJ331	C 330 OHM J 1/4W
	R1302	EXBF7E102J	RR COMBINATION
	R1304	ERDS2TJ331	C 330 OHM J 1/4W
	R1311	ERDS2TJ101	C 100 OHM J 1/4W
	R1312	ERDS2TJ101	C 100 OHM J 1/4W
	R1315	ERDS2TJ331	C 330 OHM J 1/4W
	R1316	ERDS2TJ331	C 330 OHM J 1/4W
	R1325	ERDS2TJ331	C 330 OHM J 1/4W
	R1326	ERDS2TJ331	C 330 OHM J 1/4W
	R1328	ERDS2TJ221	C 220 OHM J 1/4W
	R1329	ERDS2TJ221	C 220 OHM J 1/4W
	R1330	ERDS2TJ221	C 220 OHM J 1/4W
	R1331	ERDS2TJ820	C 82 OHM J 1/4W
	R1332	ERDS2TJ820	C 82 OHM J 1/4W
	R1335	ERDS2TJ331	C 330 OHM J 1/4W
	R1336	ERDS2TJ331	C 330 OHM J 1/4W
	R1340	ERDS2TJ101	C 100 OHM J 1/4W
	R1341	ERDS2TJ682	C 6.8K OHM J 1/4W
	R1342	ERDS2TJ472	C 4.7K OHM J 1/4W
	R1353	ERDS2TJ102	C 1K OHM J 1/4W
	R1354	ERDS2TJ101	C 100 OHM J 1/4W
	R1355	ERDS2TJ562	C 5.6K OHM J 1/4W
	R1356	ERDS2TJ101	C 100 OHM J 1/4W
	R1357	ERDS2TJ123	C 12K OHM J 1/4W
	R1358	ERDS2TJ682	C 6.8K OHM J 1/4W
	R1360	ERDS2TJ101	C 100 OHM J 1/4W
	R1361	ERDS2TJ682	C 6.8K OHM J 1/4W
	R1362	ERDS2TJ472	C 4.7K OHM J 1/4W
	R1363	ERDS2TJ123	C 12K OHM J 1/4W
	R1364	ERDS2TJ1R0	C 1 OHM J 1/4W
	R1365	ERDS2TJ472	C 4.7K OHM J 1/4W
	R1366	ERDS2TJ221	C 220 OHM J 1/4W

	Ref.No.	Part No.	Description
	R1373	ERDS2TJ332	C 3.3K OHM J 1/4W
	R1374	ERDS2TJ273	C 27K OHM J 1/4W
	R1377	ERDS2TJ562	C 5.6K OHM J 1/4W
	R1378	ERDS2TJ151	C 150 OHM J 1/4W
	R1379	ERDS2TJ472	C 4.7K OHM J 1/4W
	R1381	ERDS2TJ221	C 220 OHM J 1/4W
	R1382	ERDS2TJ1R0	C 1 OHM J 1/4W
	R1383	ERDS2TJ184	C 180K OHM J 1/4W
	R1384	ERDS2TJ221	C 220 OHM J 1/4W
	R1385	ERDS2TJ182	C 1.8K OHM J 1/4W
	R1386	ERDS2TJ102	C 1K OHM J 1/4W
	R1395	ERDS2TJ101	C 100 OHM J 1/4W
	R1396	ERDS2TJ331	C 330 OHM J 1/4W
	R1399	ERDS2TJ331	C 330 OHM J 1/4W
		OTHERS	
		ESD39703A	SWITCH
		TJE81101	TERMINAL
		TMK90004-1	BARRIER
		TMM1459	CLIP
		TMM81416	CORD BAND (SMALL)
		TMM81417	CORD BAND (BIG)
		TMM85517-1	MARK BAND(R)
		TMM85517-2	MARK BAND(G)
		TMM85517-3	MARK BAND(B)
⚠		TMM85604	RELAY CAP
⚠		TQF87254	FUSE LABEL
		TSC8909-0	FERRITE CORE (SMALL)
		TUW85304	SWITCH PLATE
		TUX80701-2	CORD BRACKET (BIG)
		TUX80971	CORD BRACKET
		TUX90039	SWITCH BRACKET
		TXAJTA3P1146	3P CONNECTOR ASSY
		TXAJTA4P394A	4P CONNECTOR ASSY
		TXAJTE6P396	6P CONNECTOR ASSY
		TXAJTE7P044	7P CONNECTOR ASSY
		TXAJTT2P326	2P CONNECTOR ASSY
		TXAJTT4P544	4P CONNECTOR ASSY
		XBA2C30NU1	FUSE(3A)
		XTB4+8C	SCREW
		XTV3+10A	SCREW
		XTV3+10C	SCREW
		XTV3+12C	SCREW
		XTV3+6C	SCREW
		XTV3+8C	SCREW
		XTV3+8F	SCREW
		XWC3BFN	WASHER
		XWGT40660	WASHER
		XWG3F10	WASHER
		XYE3+EJ10	SCREW
		2SD1264AQLB	TRANSISTOR
	AC1	TJE80301	TERMINAL
	AC2	TJE80301	TERMINAL
	CL861	TJE81110	TERMINAL
	CL862	TJE81110	TERMINAL
	CN102B	TJS87820 6	6P SOCKET
	CN103-	TXAJTE8P061	8P CONNECTOR ASSY
	F1	TEL302-9	TERMINAL
	F2	TEL302-9	TERMINAL
	F3	TEL302-9	TERMINAL
	F4	TEL302-9	TERMINAL
	FS801	TJC3316	FUSE HOLDER

	Ref.No.	Part No.	Description		Ref.No.	Part No.	Description
	FS802	TJC3316	FUSE HOLDER		RL1361	TSE80840	SWITCH
	H1	TEL302-9	TERMINAL		S311	TAGDSP301NT	SPARK GAP
	H2	TEL302-9	TERMINAL		S321	TAGDSP301NT	SPARK GAP
	JC1301	TJC6137	GNA TERMINAL		S331	TAGDSP301NT	SPARK GAP
	JC1302	TJC6137	GNA TERMINAL		S341	TAGDSP301NF	SPARK GAP
	JC1303	TJC6137	GNA TERMINAL		V1	TEL302-9	TERMINAL
	JC1304	TJC6137	GNA TERMINAL		V2	TEL302-9	TERMINAL
	JS361	TJS8A502	CRT SOCKET		V311	TJS848100	SOCKET
	JS1301	TJS878208	8P SOCKET		V321	TJS848100	SOCKET
	JS1302	TJS878206	6P SOCKET		V331	TJS848100	SOCKET
	JS1305	TJS878206	6P SOCKET		V1311-	TWH892026	CABLE
	JS1306	TEL302-9	TERMINAL		V1321-	TWH892030	CABLE
	JS1306	TEL302-9	TERMINAL		V1331-	TWH892036	CABLE
	JS1306	TEL302-9	TERMINAL				
	JS1306	TEL302-9	TERMINAL				
	JS1308	TJS878208	8P SOCKET				
	JS1309	TJS878207	7P SOCKET				
	JS1312	TJS878202	2P SOCKET				
⚠	RL851	TSE80830	SWITCH (RELAY)				
	RL1351	TSE80839	SWITCH				